

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

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Published Monthly by
FINISHING PUBLICATIONS, INC.

Serving the electroplating and industrial coating fields with specialized monthlies and guidebooks since 1903. Companion publication, ORGANIC FINISHING.

381 Broadway
Westwood, N. J.
WEstwood 5-1530

Branch Offices

Los Angeles 14, California
742 South Hill Street
MADison 6-5421

Hornell, N. Y.
19 Elmwood Place
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Devoted Exclusively to Metallic Surface Treatments

METAL FINISHING

DECEMBER, 1954

VOLUME 52 • NUMBER 12

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COMING SOON

The use of potassium oxalate as a complexing agent in the boric acid analysis in nickel solutions.

The proper rinsing techniques will cut down on poor results, solution contamination, excessive use of water and uneconomical waste treatment.

An exposure test used to evaluate the salt spray corrosion resistance of cadmium over brass and steel, and to determine the relative adhesion characteristics of cadmium to brass and steel.

Recently completed research work discloses satisfactory processes of descaling and pickling titanium.

SUBSCRIPTION INFORMATION

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This is a plain Ruff-L-Buffer after wearing off about one inch in testing operations and then trimming. Loose threads, broken material and numerous small holes due to excessive heat and abrasion of the cloth are apparent.



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Plating Is Not Always Legal

Last summer, a movie-theater operator named *Albert Greene* decided to protest New York City's new 5% amusement tax by having 36,000 pennies chromium plated by a local job shop and circulated as a reminder to his patrons of this onerous impost. Unfortunately, most of them had already been distributed by the time the *Treasury Department* reminded him of the consequences of tampering with the currency and ordered him to round up every single one of the "defaced" coins — or else!

It is doubtful whether the resulting publication of Mr. Greene's photo in *Life* magazine and the boom in his business could make up for his trouble in obtaining return of the coins, which included the offer of two for one and removal of the plating. Or, for the uneasy moment a few days later, when he had to admit to the *Secret Service* agent that 12,200 of the chromed pennies appeared to be unrecoverable despite his anguished efforts.

We had intended to summarize the applicable laws and penalties so that platers would avoid becoming involved in the future, but our request to the Treasury Department at that time for information remains unanswered. Therefore, all we can tell our readers is, if they want to plate coins, first make sure they are foreign ones.

To us, the most interesting part of this story was the discovery that a number of youngsters were offering for redemption pennies they had plated with their home chemistry kits. On the two for one exchange basis, they were well on their way toward a financial killing until parents were begged, in a message flashed on the theater screen, to control the "junior counterfeiters" in the family. If, a dozen years from now, the roll of platers in Brooklyn takes a sudden jump, we will be sure that this newly developed interest in the subject on the part of the younger generation was definitely not of a transitory nature.

Nathaniel Hall

Metal Finishing

Wishes You A Very Merry Christmas and A
Happy and Prosperous New Year

A Survey of Chromate Treatments

By Walter E. Pocock, *Allied Research Products, Inc., Baltimore, Md.*

Introduction

CHEMICAL surface treatments of various kinds play an indispensable role in the metal finishing industry. An increasingly prominent group of these are the protective chromate conversion treatments, applied to zinc, cadmium, aluminum, magnesium, and cupreous alloys either as a final finish or as a base for paint. Early efforts with chromates were, in the main, applied to various treatments for zinc and cadmium. However, in recent years most of the commonly used surface treatments for magnesium and aluminum are of the chromate dip type. Copper and its alloys are also gaining in the use of chromate treatments. Because of the ever broadening use of this type of protective finish, it is intended to present here an overall picture of their scope of application, and a classification according to metals to which they can be applied.

The growth of chromates has been due primarily to their ability to protect the aforementioned metals against corrosion, particularly that due to exposure to moisture and humid atmospheres. The type of corrosion problem encountered may vary from simple tarnishing to more severe types of breakdown, such as the formation of white rust on zinc, and the white corrosion and pitting of aluminum and magnesium. All of these varied corrosion problems have been successfully dealt with by the application of chromate coatings. In addition to affording corrosion protection, chromate treatments in many cases enhance the appearance of the metal surface by providing metallic bright or attractively colored finishes. Chromates also make excellent bases for paint and other organic finishes, which do not adhere to untreated metals. As will be explained, the chromate film not only improves initial adhesion but also prolongs the life of the organic finish.

Nature of Chromate Coatings

All chromate conversion treatments use chromic acid or one of its soluble salts, which contain chromium in the hexavalent state. Water solutions of hexavalent chromium compounds alone do not react to any appreciable extent with the metals involved in this discussion. However, a reaction can be brought about by the addition of other chemicals which serve as activators. If the clean metal surface is immersed in such a solution, properly formulated, a thin film, or conversion coating, is produced. This film has the desirable characteristic of retarding corrosion of the metal surface. The term "conversion coating" refers to the fact that surface metal is converted into a non-metallic form

in the film-producing reaction. Coatings vary greatly in both appearance and protective value. A variety of coatings is obtainable with each metal, but the range of coatings possible differs from one metal to another. In order to clarify this picture the various metals subject to chromating are classified into groups, below, and the types of coatings obtainable with each group are shown. The colors indicated are of the coatings as formed. As will be seen, appearance can in many cases be modified by further treatment.

Group I — Zinc and Cadmium: Metallic bright, light iridescent, iridescent yellow, bronze, olive drab, black.

Group II — Copper, Brass, Bronze: Metallic bright, yellow.

Group III — Aluminum Alloys: Clear, iridescent yellow, brown.

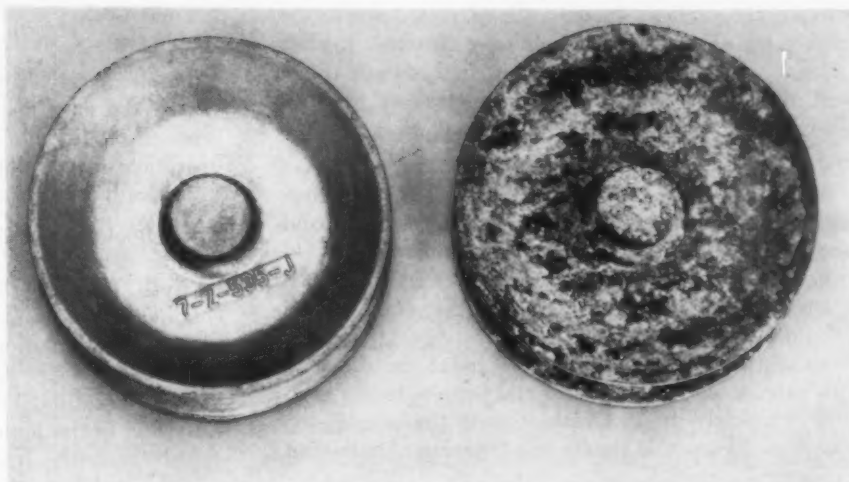
Group IV — Magnesium Alloys: Metallic bright, iridescent yellow-red, brown, black.

A detailed discussion of treatments as applied to each of these groups is undertaken in a later section of this article.

Historical Background

The use of chromate baths for coating magnesium was known as early in 1924. Brass-colored, brown, and black films were obtained from acidified solutions of sodium dichromate, with or without the addition of certain metal salts.¹ A number of other chromate treatments for magnesium, zinc, cadmium, and copper alloys appeared between 1924 and 1936. One that found wide application was a bright dip for cadmium.² Undoubtedly the most important of the early developments was a dichromate-sulfuric acid process, patented March 24, 1936. In this treatment light iridescent, yellow, and bronze-colored coatings are obtained on zinc and cadmium.^{3,4} A subsequent development was the use of solutions of chromic acid and sulfates, followed by dilute acids or alkalis, to obtain a metallic bright finish.⁵ During World War II a process was introduced which produces, on zinc and cadmium, olive-drab colored coatings, having greater corrosion resistance than the previously obtained light iridescent to bronze films.^{6,7} Besides the olive drab color, black and other colors can be obtained by dyeing the olive drab coating.⁸ Another development was an electrolytic chromate treatment for zinc.^{9,10} Many of the proprietary treatments for zinc and cadmium in use at present are improved versions of the original dichromate-sulfuric acid process.

Aluminum sand castings, left: treated, right: untreated, after 120 hours salt spray exposure, illustrating corrosion retarding effect generally characteristic of chromate films.



Chromates on copper and its alloys, have evolved mainly as chemical polishing bright dips providing some degree of passivity. Heavier, more protective films are now available where appearance is of relatively little consequence.

The development of protective finishes for magnesium has thus far been carried on and encouraged largely by the magnesium producers themselves. A great number of treatments of various types have been devised over the past thirty years. Relatively few of these have survived in commercial use, and the most widely used of these are of the chromate type.

Chromate treatments for aluminum have attained prominence in recent years and in general, are a decided improvement over earlier chemical treatments. Two of the earlier processes, interestingly, make use of hexavalent chromium compounds, although neither can be classified strictly as a chromate treatments. One is an alkaline process producing grey aluminum oxide coatings which are subsequently "sealed" in a potassium dichromate solution.¹¹ The other, a proprietary process which uses essentially chromic as well as phosphoric acid, gives a light green phosphate-type coating.¹² The first true chromate conversion treatment for aluminum was introduced in 1950.¹³ A high degree of corrosion protection and simplicity of operation have led to its wide usage. Several other similar treatments have appeared more recently.

Most chromate treatments in use at present, except those for magnesium, are of the proprietary type. Users are supplied with powdered compounds or liquid concentrates, from which working solutions are made up and operated according to manufacturers' recommendations. A variety of formulations, tailored to meet specific requirements, are available. Although different proprietary treatments are similar in operation and results obtained, no two are exactly interchangeable. The present discussion proposes to cover the important principles involved in chromating, and is not concerned with detailed differences between individual proprietary treatments.

Method of Applying Chromate Coatings

Extreme simplicity of operation is one of the attractive features of most chromate treatments. The chromating step itself is usually only a simple immersion in the chromate solution. Processing times, including cleaning, are short. Although there are one or two electrolytic chromate treatments, electrical power is usually not required. Since no fumes are evolved in most cases,

ventilation is not necessary. The essential items of equipment are rinse tanks, an acid resistant container for the chromate solution, and baskets, racks, or hooks for handling the work. Acid resistant materials commonly used include stoneware, stainless steel (where solutions do not contain hydrochloric acid or chlorides) and acid-resistant plastic. Most chromate solutions operate at, or near room temperature. Although a certain amount of temperature control is necessary, this is never extremely critical. Provisions for moderate heating during cold weather is very desirable, but not always necessary.

Constant efforts are being made to simplify the chromating of metals. As an example, in the case of magnesium, most effective chromate processes up until recently have been somewhat cumbersome and time-consuming. Now a new proprietary treatment is demonstrating that highly protective chromate films can be produced by a simple room-temperature process in a matter of seconds.

Flexibility of chromate formulations permits adaptation to a variety of operating conditions. For example, in the chromating of plated work in automatic machines, formulations can be modified to fit predetermined time cycles. For automatic processing of other than plated work, chromate formulations have been adapted to already-available automatic equipment. Chromates have also been adapted to spray application, and in most cases lend themselves readily to application by simple brushing or swabbing of the metal surface.

The steps involved in a typical chromating dipping process can be illustrated as follows:

- | | |
|-------------|-----------------------------|
| a. Pretreat | e. Bleach or dye (optional) |
| b. Rinse | f. Rinse |
| c. Chromate | g. Dry |
| d. Rinse | |

Proper pretreatment, step "a", is quite important, the object being to provide a properly cleaned surface. Chromate treatments have little or no value as cleaners in themselves. Pretreatment of other than plated articles consists of first removing oil, grease and other lightly adhering soil and leaving the surface in a completely wetted condition. If the metal contains surface oxides as well, an acid dip or pickle of some kind is generally used to remove these oxides and generally

activate the surface. In the case of plated work, the freshly plated metal can be directly chromated, after rinsing, without further treatment, although a dilute acid dip is sometimes used as a neutralizer prior to chromating, where residual alkaline plating solution may be excessive.

As with any other finishing process, thorough rinsing is highly important throughout the cleaning and treating cycle. A final hot rinse can be used as an aid to drying, subject to limitations imposed by individual treatments. Drying is carried out by conventional methods, such as air blasting, centrifuging, or circulating warm air. Handling at this point must be done with care, since films are soft and subject to abrasion until completely dried. Overheating in the drying step is undesirable, as this results in a lowering of corrosion resistance.

The bleaching or dyeing step, step "e", is used in some cases for modifying appearance by either removing or adding color.

Bath Composition and Control

Essentially, the chromate bath is an acidic water solution of a soluble hexavalent chromium compound plus one or more activators. Specific formulations will not be discussed here, but certain general principles will be outlined which apply generally to chromate solutions.

Hexavalent chromium compounds are recognizable by their yellow, orange or red color. compounds most commonly used are chromic anhydride (chromic acid), sodium dichromate and potassium dichromate. Activators vary according to the treatment, and include both inorganic and organic chemicals.

The combination of hexavalent chromium concentration, activator concentration, and pH, i.e., the "chemical balance" of the solution, largely determine the type coating that will be obtained, or whether a coating will be obtained at all, at a given temperature and immersion time. It is important that these factors making up chemical balance be properly controlled. As the solution is depleted through use, it is replenished by maintenance additions, as indicated by control tests. Fortunately, analysis for each separate ingredient in a chromate bath is not necessary for proper control. Usually the most critical factor in control is pH. A very effective control method uses pH and hexavalent chromium content, the former being determined with an electrometric pH meter and the latter by a simple titration. Additions are made to the solution to keep these two factors within operating limits. The amount of control actually required for a given treatment depends on how broad its operating limits are, and on the degree of uniformity of results desired. Control by pH alone is adequate in some cases. A method comparable to pH measurement is the determination of total acidity by titration. This is somewhat unreliable because of metal buildup in the solution, causing buffering. Control by specific gravity has the advantage of simplicity, but the disadvantage, again, of inaccuracy due to metal buildup. Where desired, control by the appearance of the work alone is possible.

Sample work pieces or panels can be used as color standards.

Besides hexavalent chromium compounds and activators, the bath may contain other substances which serve to modify the appearance of the coating or the operation of the solution. Such additives do not appear to critically affect the chemical balance of the bath.

Chromate baths cannot as a rule be maintained indefinitely, but must be dumped periodically and made up fresh. The inoperative point is reached when normal coatings are no longer obtained even though control tests show the solution to be in proper chemical balance or, when excessive additions are required to keep the bath in operation. This inoperative condition is apparently due to the buildup of contaminants, such as trivalent chromium from the film-forming reaction, dissolved metal from the work being treated, and miscellaneous contaminants dragged into the solution. Expected bath life varies with the treatment, and depends also on the thoroughness of cleaning and rinsing, and dragout.

General Properties of Chromate Films

Relatively little is known about the composition and structure of chromate films. A few generalizations can be made, however. It is fairly well established that most films are gel-like rather than crystalline. Films are soft and absorptive while freshly formed and still wet. On drying, they "set" or harden, and become rather non-wettable and impervious to aqueous solutions. The hardening process appears to continue, at a slow rate, for some time after drying. Yellow films owe their color to soluble hexavalent chromium compounds. These soluble compounds can be leached out by subjecting the freshly formed coating to dilute solutions of acids or alkalis. An insoluble film, which may or may not be visible, remains. Water alone has this same leaching action, but at a much slower rate. Leaching is accelerated by increasing temperature. Prolonged acid or alkaline leaching will result in eventual removal of the insoluble as well as the soluble portion of the film.

In the film-forming process hexavalent chromium oxidizes the metal being treated and is itself reduced to the trivalent form. Insoluble compounds are precipitated on the metal surface. A typical yellow film formed on zinc by the dichromate-sulfuric acid treatment was found to contain largely trivalent and hexavalent chromium.⁴ The chromium in this particular film is thought to be in the form of either a basic chromium chromate or chromic hydroxide plus soluble chromates.¹⁴ Brown and black coatings may contain basic chromium chromates of varying composition. Olive drab coatings on zinc very likely owe their color to trivalent chromium compounds. The insoluble colorless films remaining after leaching of soluble chromates may be largely chromic oxide or hydroxide plus water of hydration.

Depth of color of films as formed is an approximate indication of thickness, which is never likely to be more than 0.00002". As a rule, a negligible amount of metal is theoretically necessary to film formation. In practice, however, the amount of metal removed from the surface varies with the treatment. For example,

with chemically polishing solutions, a certain amount of metal is lost to the solution in obtaining the polishing effect. Because of their extreme thinness, coatings have no optical covering power, and so will not hide irregularities in surfaces to which applied. Such irregularities may, in fact, be accentuated, since they represent varying compositions of metal with which the chromate solution reacts selectively.

In considering the protective value of chromate films, it should be emphasized that corrosion problems of the metals with which we are dealing are caused largely by exposure to moisture, such as atmospheric condensate. Salt spray¹⁵ is used almost universally as a standard accelerated corrosion test. Corrosion resistance is due partly to the slow leaching of soluble hexavalent chromium compounds during exposure to moisture. This corrosion inhibiting ability of chromates in aqueous solution is well known, and is frequently cited in explaining protectiveness of chromate coatings. Some coatings, however, contain apparently little or no soluble chromate, yet have excellent protective value. In cases where the soluble hexavalent chromium compounds have been completely removed by leaching, the remaining insoluble portion of the film retains a major part of the original protective value. Thus, corrosion resistance is afforded primarily by the insoluble part of the film and is further improved by the soluble constituents. Baking of coatings at temperatures of 200°F. or over tends to convert the soluble chromate into an insoluble form. There is some loss of salt spray resistance, although, again, a large part is retained. The loss in this case appears to be due partly to dehydrating and cracking of the film. At the same time, a general hardening effect results from such elevated temperature, and increased resistance to alkalis and acids has been observed.

Corrosion resistance of a chromated surface depends on the corrosion resistance of the metal itself. Thus, for example, a chromated magnesium surface breaks down in salt spray or other corrosive atmosphere much faster than chromated zinc. On a given metal, protective value with any particular treatment is roughly proportional to the thickness of the film as formed, as indicated by depth of color. This does not mean that protective value of any chromate finish selected at random can be estimated solely on the basis of color. Corrosion resistance not only varies with the treatment, but other factors are involved, such as the condition of the metal prior to treating, cleaning and rinsing cycle used, treatment after chromating, and plate thickness in the case of plated metal.

Galvanic corrosion, i.e., that due to contact between dissimilar metals, is effectively retarded by chromates. Yet where electrical contact is involved resistance is low enough that chromate films are advantageous in electrical circuits, as discussed below. Maximum protection is obtained where a chromate film can be applied to both metals.

"Self-healing" is an important property of chromate films. If the film is scratched through, the exposed metal is protected by the "bleeding" of soluble chromate in the area surrounding the scratch. "Scratch tests" are frequently made as a part of test procedures in salt spray evaluations.

Low electrical resistance of chromate films is a valuable property that has been widely exploited. It is known that resistance varies from one type of coating to another, but numerical values are difficult to state in simple terms since, in measuring this property, results depend largely on how measurements are made. It may be stated generally that chromates have been widely accepted in the electronics field because of the fact that, for many applications, electrical resistance is low enough to be negligible or not objectionable.

On the negative side, chromate films are relatively low in wear resistance, and this must be considered when they are to be used as final finishes. Partly offsetting this is the fact that, when properly formed, films are tightly bound to the metal surface and do not tend to peel or flake off. Also, if the film is scratched through to the metal, protection is still provided as referred to above.

In considering chromates as bases for organic finishes, two factors are important. First is the improvement of initial adhesion of organic coating to metal. Some surface treatments do this through a "tooth" effect, i.e., mechanical interlocking with undercut pits in the metal or with the rough surface of the chemical coating. Chromate coatings, on the other hand, are believed to provide bonding through molecular adhesion. The chromate film is bound to the metal surface by molecular attraction and, in turn, holds the organic film by the same mechanism. The second factor is extending the life of the organic coating. In this, chromate films have an advantage over other paint-base coatings which do not in themselves have a corrosion-inhibiting effect. The chromate film forms an effective barrier against either corrosive attack through pores or scratches in the organic coating, or a reaction between the metal and the organic coating itself. A further advantage of chromates is that, since films are thin and non-porous, there is little or no absorption of paint or other applied organic material, thus affording more economical use of the organic coating as compared with certain crystalline-type paint-base coatings.

(To be concluded in next issue)

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Ion Exchange a Practical Tool in the Plating Room

By R. J. Keating, *Manager, Industrial Waste Treatment Department, Graver Water Conditioning Co., New York, N. Y.*

ION exchange as a practical tool in plating operation is growing in use every year. As competition grows keener, more plating plants are examining the method for possible cost savings, improving quality of work, and reducing rejected products. Increased pressure from state and municipal authorities to eliminate plating waste disposal in streams and sanitary sewers has made ion exchange more attractive as a possible means of solving waste problems at reasonable cost.

In general, there are three ways in which ion exchangers are now being used in plating operations. These are:

1. Treatment of water for plating room use.
2. Purifying plating baths by removal of heavy metal contaminants.
3. Treatment of rinse waters for valuable metal recovery and waste treatment.

Other special applications have been developed, such as selective separation of plating bath constituents, but these are largely in the experimental stage at the present time and involve special techniques beyond the scope of this article. They are mentioned here only to point up the growing place of ion exchange in the industry.

How Ion Exchange Works

Before discussing applications of ion exchange, it might be well to review briefly what it is and how it works. Ion exchange may be defined as the exchange

of ionized atoms or radicals between a solution and a solid in an action causing no change in the physical structure of the solid. The solid referred to is usually a synthetic resinous particle which takes an ion from a solution passing through and replaces it with a different ion. After a time, all the replaceable ions are removed and the resinous material is no longer capable of exchanging ions. When this happens, the material is regenerated — that is, restored to its original form — by passing another solution through which contains the original exchangeable ions. Obviously, choice of proper resin and of the right regeneration solution and method are of prime importance. A photomicrograph of a typical styrene cation resin is shown in Figure 1.

Treatment of Water for Plating Room Use

It has long been recognized that calcium and magnesium in water cause problems in the plating plant. These chemicals produce sticky insoluble curds with soaps, and form other compounds which may cause spotting or staining on the finish. It has been standard practice in many plants to soften water by salt-regenerated ion exchange equipment, thereby eliminating calcium and magnesium from all waters. Later it was found that other impurities in water, notably carbonates and chlorides, interfere with specific plating processes. Such plants have found it advantageous to install demineralizers — ion exchange units which produce water equal to, or better than, distilled water purity. These systems consist of acid-regenerated cation exchange resins followed by alkali-regenerated anion exchange resins. In a mixed-bed demineralizer both of the required resins are combined in a single tank. In either case, practically all ionized dissolved solids are removed and mineral-free water is available at 10% to 50% of the cost of distilled water in the great majority of cases. A typical demineralizing plant is shown in Figure 2.

Purifying Chromium Plating Solutions

For simplicity, the discussion will be confined to chromium plating solutions. Many plating plants, especially those doing decorative chromium plating, have sufficient dragout from plating baths so that contamination is kept within limits. Other plants build up contamination as the baths are used, and either the

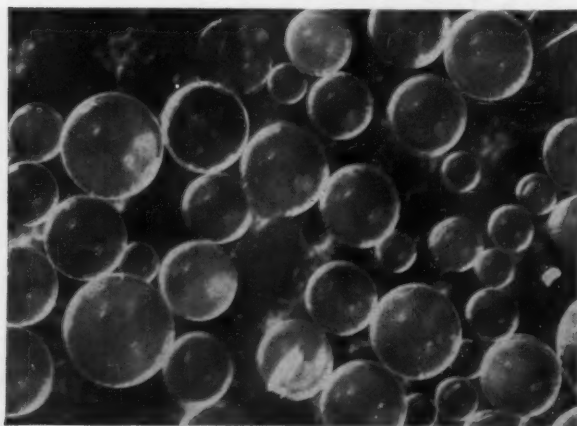


Figure 1.

entire bath must be replaced or, as is generally the case, a part of the bath is discarded and fresh chromic acid added thereby reducing contaminant concentration. Costa in 1950 showed that the level of contaminants could be kept low by means of hydrogen-regenerated cation exchangers. Since chromic acid, in normal chromium plating bath concentrations, would cause excessive oxidation of the resin, it is necessary to dilute these solutions to about 14-16 oz. of $\text{CrO}_3/\text{gal.}$ before putting them through the exchanger. The chromate anion passes through the cation exchanger, and the iron, aluminum, trivalent chromium and other contaminants present as cations, are effectively removed. The effluent is a purified chromic acid which is concentrated in a glass-lined evaporator and returned to the bath. By purifying the baths as described, there is no need to dump valuable solutions, and costly waste disposal is eliminated.

Anodizing Solutions

Anodizing solutions are handled in the same way except that no dilution of the bath is necessary. Very good aluminum removals are obtained by cation exchangers by cycling a part of the bath through the unit when necessary. Another advantage is that, by using split elution of regenerant, purified chromic acid is recovered at a concentration which can be returned directly to the plating bath.

Treatment of Rinse Waters

At many plants losses by dragout prevent build up of bath contaminants. Such plants necessarily lose valuable plating chemicals and, frequently, have a serious waste disposal problem. Toxic chemicals are present in small quantities in large volumes of water, but still at concentrations which do not permit discharge to streams or sewers. Ion exchange should be examined as one means of solving this problem. Again, chromium plating solutions can be used to illustrate this method.

As we have seen, the hexavalent chromium is the anion form. Recovery of this anion not only greatly reduces the toxic effect of the wash, but also reclaims the valuable chemical. The rinse solutions which formerly were dumped into the sewer are, instead, diverted to an anion exchanger. In this exchanger the chromate compounds are concentrated and the cationic impurities and water go through.

Concentrated chromates are removed from the exchanger by regeneration, usually with sodium hydroxide. This mixture of sodium chromate and sodium hydroxide from the anion unit can then be passed through a cation exchanger where the sodium chromate is converted to pure chromic acid and the sodium hydroxide to water. The diluted chromic acid can be strengthened with fresh chromic acid, or can be evaporated to the desired concentration in a glass-lined evaporator. In either case, the valuable chromates are removed from the waste stream and returned to the bath.

A cation exchanger (in most cases the same one used to convert the sodium chromate) can be used to purify the rinse stream effluent from the anion exchanger and thus provides a continuous supply of demineralized water from rinse. Raw water to make up evaporation and other losses can be demineralized by passage

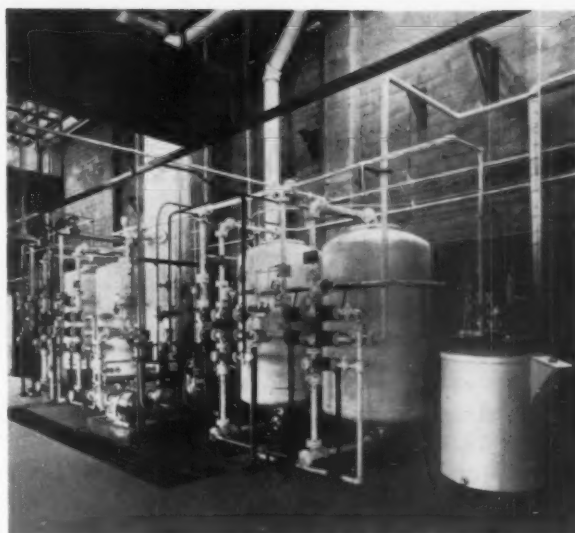


Figure 2.

through in the same system in reverse — that is, cation followed by anion, as described for demineralizing.

While the system described is for a chromium bearing rinse stream, use of cation exchange for removing copper and nickel from rinse streams is often feasible. It must be remembered that ion exchange is primarily a method of concentrating these metals.

Since one of the most difficult problems in waste disposal is the large quantity of water with low concentrations of pollutant in the waste stream, treatment methods are frequently simplified by using ion exchange to reduce gallonage to be treated. This is true even if the concentrated waste is to be disposed of rather than recovered.

As described in the following example, at times ion exchange can be combined with batch chemical treatment to provide the most economical answer.

Examples of Successful Ion Exchange

How these systems are used in plating operations can best be shown by comparing problems solved at actual plants.

PLATING BATH AND RINSE WATER RECOVERY:

Plant A is using a chromic acid bath as a bright dip following zinc plating. There is heavy zinc contamination of the baths and considerable formation of trivalent chromium. Waste treatment facilities were required on plant effluent. After careful study the plant layout shown in Figure 3 was selected.

Purification of the chromic baths was necessary in this case because contaminants were building up faster than they were removed by dragout. The baths are recirculated through a hydrogen regenerated cation unit designed to completely recycle one bath every 24 hours. The waste acid from the regeneration is neutralized in a rubber-lined tank supplied for that purpose. The cation unit was designed to remove 23 pounds of trivalent chromium and 60 pounds of zinc per day.

At the same time, a substantial amount of chromium was being carried over in dragout from the baths to the rinse tanks. Studies indicated that approximately 90 pounds per day of chromic acid were being lost in

the rinse solution at a concentration of about 400 ppm. This represented a substantial loss of chemical and it was necessary to remove the chromate completely from the rinse stream in order to comply with stream pollution regulations. Recovery of the chromate was accomplished by using anion exchangers regenerated with sodium hydroxide.

Regenerant from the anion was passed through the cation unit and recovered as 4-6% chromic acid. This acid is stored in a Koroseal-lined tank until required for bath makeup. The last portion of caustic solution through the anion exchanger is very low in chromates and is recovered in a second tank to be used as the first part of the regenerant on the next cycle. This reduces chemical operating cost and also gives higher concentration of acid from the cation unit.

In the original design it was contemplated that a small salt regenerated cation unit would be used for softening makeup water to the rinse tank. It was necessary that softened water be used not only to eliminate calcium-magnesium deposits on the plated surfaces, but also to avoid fouling the anion resin bed. By careful scheduling, it was possible to eliminate the softener and use the hydrogen regenerated cation unit with the anion units to produce demineralized water.

The final plant consists of two anion units for removal of chromates from the rinse water, and one cation unit used part of the time to reduce plating bath contamination by removing zinc and trivalent chromium from the bright dip solution, and part of the time to convert recovered chromate from the rinse system to chromic acid for reuse. Because of the dual purpose served by the cation unit, it is necessary to regenerate twice a day, using sulphuric acid as the regenerant. The cation tank is lined with Koroseal and PVC lined wrought steel pipe and fittings are used. Boltaron pipe and fittings were used for the anion

units. Saunders patent valves with Saran body and Teflon diaphragms were used throughout the system. Control is manual with provision for conversion to automatic control, which is now under consideration.

RINSE WATER TREATMENT ONLY:

Plant B faced a different problem. In the design of this plant experience at a previous plant indicated that no serious contamination of the plating bath would occur because of the high losses from dragout. Since this was a new plant, it was necessary to develop a system which would insure elimination of any stream pollution problem. A secondary consideration was the recovery of chromates which were lost from the plating baths in the rinse streams. It was this possibility of economic recovery of the chromates which led to the choice of ion exchange for this system. It was found that the operation cost with this method was substantially less than with any alternate method investigated.

After careful study it was decided to segregate the chromium bearing streams from the other plating rinse streams and treat each separately. No attempt was made to recover metals except in the chromium bearing streams. The chromate recovery system consisted of a caustic regenerated anion unit followed by an acid regenerated cation unit. Operation of the system followed the same general pattern as that previously described for Plant A. The chromates were concentrated in the anion unit, stripped off during the regeneration step and converted to chromic acid by the cation exchanger. A glass-lined evaporator was included in the system to concentrate the dilute chromic acid to proper bath concentration. Full automatic operation was provided at this plant with cycle controllers on a time sequence to actuate the automatic control.

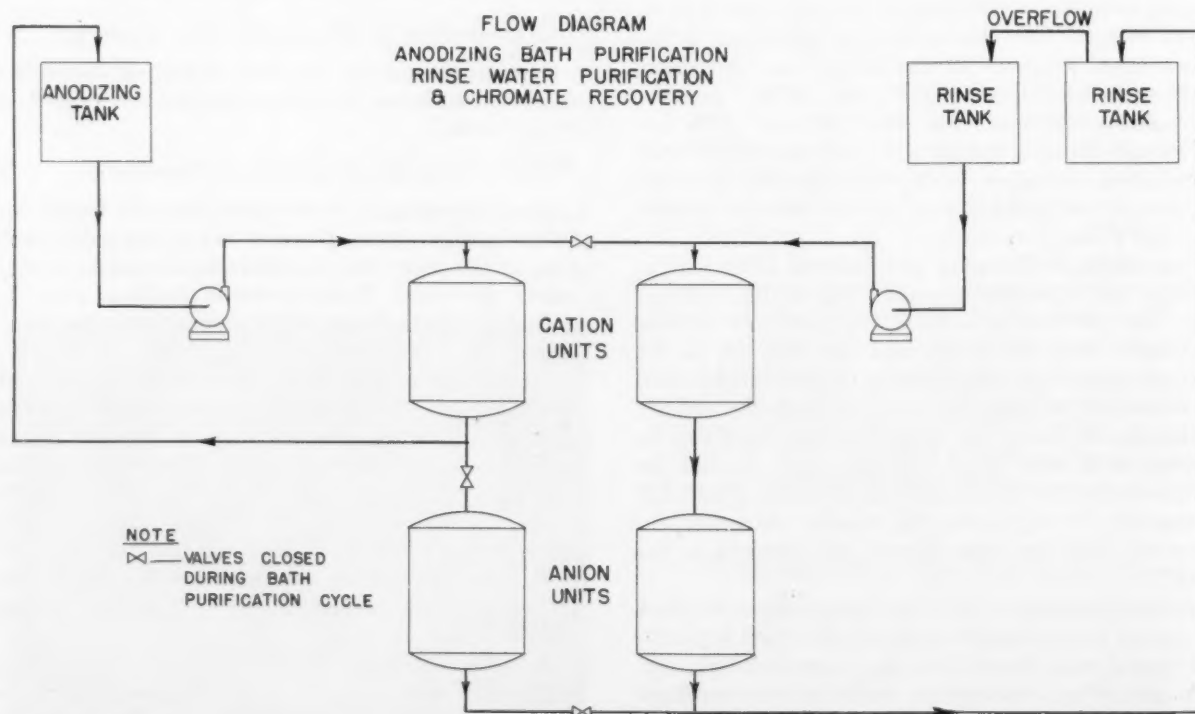


Figure 3.

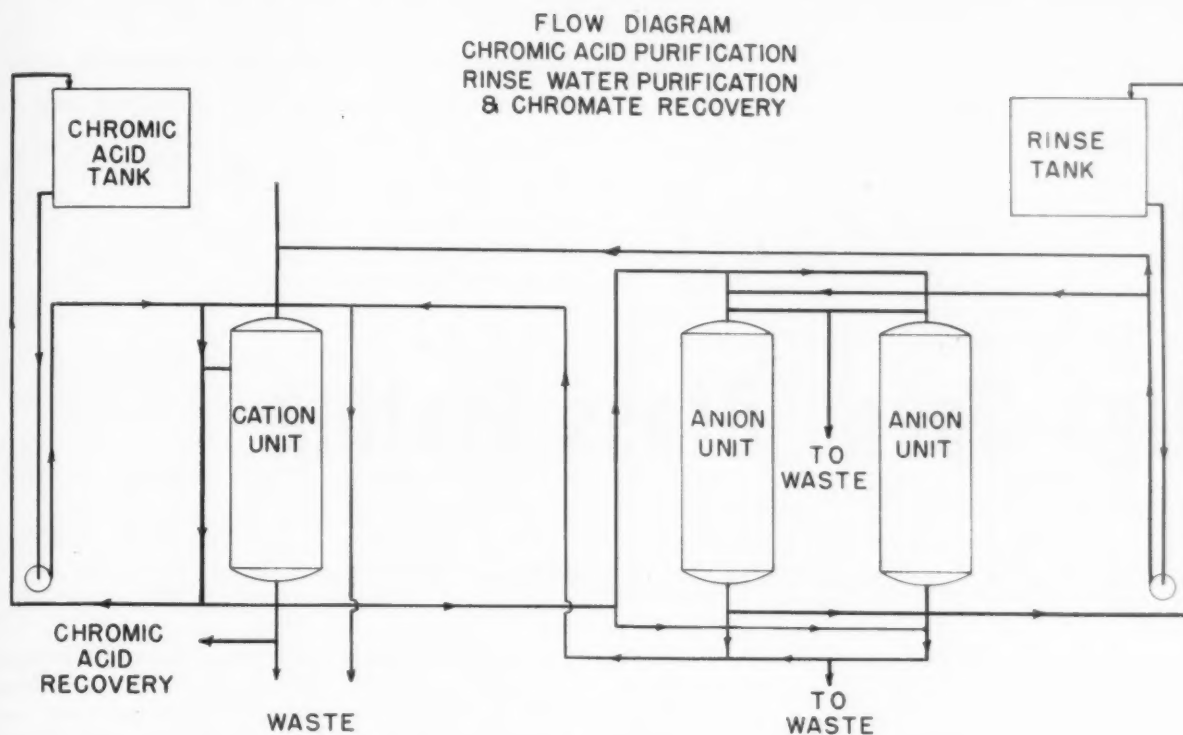


Figure 4.

A separate system was provided for concentration and disposal of the general plating rinses other than chromate. This system consisted of a cation unit to separate heavy metals from the waste stream. These metals were removed from the exchanger during the regeneration step and pumped to a neutralizing tank for treatment with caustic. Neutralized precipitates were then dewatered using a vacuum filter, and the filter cake was carted away. Rinse streams from the cation were fed to an anion exchanger to produce demineralized water for recycle to the general rinse. City water was used for makeup to this rinse stream and was also run through the demineralizer, as required, before being added to the general rinse.

ANODIZING BATH AND RINSE WATER TREATMENT:

Plant C is an aluminum anodizing plant. This plant was under severe pressure by municipal authorities to eliminate chromium from the waste flowing to the sanitary sewer. An economic study was made of the comparative cost of chromium disposal by conventional methods as opposed to recovery by ion exchange. At this plant it was found that the ion exchange recovery system was substantially cheaper on an installed basis than conventional disposal methods. Decision was made, therefore, to install an ion exchange recovery system as shown in Figure 4. Aluminum showed a tendency to build up in the anodizing bath to a point where the plating would not meet the 250 hour salt spray requirement. It had been the practice to dump and destroy a portion of the anodizing solution once a week in order to eliminate this build-up. By use of a cation exchanger, the aluminum was removed from the anodizing bath on a regular cycle, and a very low level was maintained. Chromates were recovered from the rinse solutions using the "reverse

demineralizer" system previously described. By using the split elution technique, it was possible at this plant to recover the chromates as chromic acid in a concentration which could be recycled directly to the anodizing baths. Although the recovered chromic acid was slightly below the desired concentration evaporation of water in the anodizing baths quickly brought it up to the desired figure. In addition to a lower initial cost for ion exchange equipment at this plant, as contrasted with conventional chromate disposal methods, a substantial reduction in operating cost is achieved each week due to the chromates recovered through ion exchange. Since the plant had been using city water for rinsing, recycling of the rinse solution also gave an important cost reduction. Of equal importance is the fact that the stream pollution problem, which threatened to become a very serious factor in operation, has been completely eliminated.

Summary

It should be emphasized that ion exchange is not a cure-all for plating waste treatment. The first step should be a review of plating room operations to see if, and where, water and chemical losses can be reduced. When necessary corrections have been made, a simple economic study will often define the correct method of treatment. Consideration should be given to probable growth of facilities and to additional plating processes which may be contemplated. Volumes of solution and value of chemicals will aid in the selection of recovery as opposed to batch or continuous disposal.

In either case, whenever waste disposal is a problem and has to be considered in the operation of a plating plant, ion exchange should always be considered as a proven working tool for the plating industry.

High Speed Brass Plating

By Theodore Z. Voyda, Technical Director, Apothecaries Hall Co., Waterbury, Conn.

Introduction

WHILE most common types of plating solutions have been the result of development and subsequent adoption of a great variety of high speed baths, brass plating has had comparatively little work along these lines. During the past conflict, a shortage of brass metal created interest in a heavy (0.001" to 0.0015") brass deposit which, when plated on steel, could be buffed to a finish simulating that produced on solid brass parts. The conventional brass solutions¹ commonly used were not practical in such applications; heavy deposits capable of taking a buff required very long plating times since current densities of only 3 to 5 amp./sq. ft. were permissible. Thus, to obtain a smooth easily buffable deposit of 0.001", plating times might easily reach or exceed three hours. Such plating times were impossible when automatic plating equipment was considered and uneconomical for still tank installations.

In a preliminary investigation of possible high speed brass and related copper solutions, the potassium and sodium high speed copper solutions, as developed by Wernlund, Benner^{2, 3, 4, 5} and others, appeared of interest. Unpublished work from their laboratories on a bright high speed brass solution using potassium salts furnished a starting point for the present investigation which, however, was not concerned primarily with the obtaining of a bright plate but rather with a heavy buffable plate of satisfactory color. Use of potassium salts was considered because of the lower metal concentrations which could be used with increased current densities. Thus, the potassium solution was felt to give greater operating flexibility than a corresponding sodium solution.

Solution Composition

The composition which the investigation found to be most satisfactory from all standpoints is first presented

here along with limits of concentration and operating conditions.

MAKE-UP:

Copper Cyanide	5.9 oz./gal.
Potassium Cyanide	16.7 "
Zinc Cyanide	2.3 "
Potassium Hydroxide	2.0 "
Potassium Carbonate	4.0 "
Sodium Thiocyanate	1.5 "
*Anti-pit	4 cc./gal.

*Quaternary ammonium derivative.

OPERATING CONDITIONS:

Copper (as metal)	4-6 oz./gal.
Zinc (as metal)	1.0-1.7 "
Free Cyanide	4.5-6.5 "
Potassium Hydroxide	1.5-2.5 "
Potassium Carbonate	2-10 "
Sodium Thiocyanate	0.5-2 "
Anti-pit	2-8 cc./gal.
Copper/zinc ratio	2-3.5 to 1
Cathode current density	1-40 amp./sq. ft.
Anode current density	5-20 "
Temperature	110-120°F.
Anodes	80% Cu/20% Zinc

In the ensuing discussion we will attempt to outline various factors which influence the operation of the solution. Particular attention will be paid to the effects of variables on color — the most important factor in brass plating.

Effect of Free Cyanide and Temperature

Free cyanide and temperature, working together, were found to exert the greatest influence on color and thickness of plate. To study the effect of these variables, solutions were prepared which were standard (as given in make-up composition above) in all constituents except for the free cyanide. The free cyanide is

TABLE 1

Effect of Free Cyanide and Temperature on Color & Thickness of Brass Deposit

Free cyanide oz./gal.	Temperature		
	86°F.	120°F.	180°F.
2.5	pale yellow blistering & staining	pale pink blistering & staining	pink blistering & staining
4.5	yellow staining thickness—0.00015"	yellow thickness—0.00025"	pink thickness—0.00036"
5.5	yellow slight staining thickness—0.00010"	yellow thickness—0.00015"	pink thickness—0.00036"
6.5	yellow, with faint pink tinge thickness—0.00003"	yellow thickness—0.00015"	pink-yellow thickness—0.00030"
9.5	pink-yellow thickness—not measurable	yellow thickness—0.00008"	pink-yellow thickness—0.00030"

regarded here as the amount of potassium cyanide in excess of the theoretical amounts required to react to form the complexes $K_2Cu(CN)_3$ and $K_2Zn(CN)_4$. Actual titrations of the free cyanide using the methods of Heiman & McNabb⁶ gave results within 0.1 oz./gal. of theoretical amount. Flat mild steel cleaned panels were directly plated for 10 minutes at 20 amp./sq. ft. Effects were noted at 86°F., 120°F. and 180°F. Results are shown in Table 1. Plate thicknesses are average thicknesses as determined by the Magne-Gage. Being an average thickness, readings may have an undetermined error of a few hundred-thousands of an inch. For comparison purposes the figures are felt to be reliable.

Results show that, as temperature is raised, free cyanide must be raised if yellow deposits are to be obtained. Operation at the lower temperature (86°F.) with lower free cyanide did not prove desirable because, although the deposit color was yellow, plate thickness was less than at the higher temperatures. At the other extreme of temperature (180°F.) plate thickness was greatly increased; however, deposits were pink throughout the free cyanide range tested, although they become less pink as the free cyanide increased. The results follow, in general, the accepted theories in alloy plating namely that, as temperature is increased, the copper content of the deposit increases, causing pinks to appear, while an increase in free cyanide has the opposite effect. As the free cyanide was raised at any given temperature, a marked reduction in plate thickness occurred. The best yellows in acceptable thicknesses were at temperatures at or near 120°F.

Another effect noted at the low free cyanide levels was lack of adhesion. This was expected because the low free cyanide of the higher efficiency solutions favors formation of poorly adherent immersion deposits. Increase in the free cyanide overcomes this difficulty and obviates a strike deposit prior to brass plating. For consistently good results, free cyanide should be run at 4.5 - 6.5 oz. with temperatures at 110-120°F.

At this point it might be well to discuss the meaning

of color as applied to these deposits. When the solution was operated at optimum conditions, the yellow color referred to in the tables means the light golden color which, when buffed, matches the buffed surface of an 80/20 rolled brass sheet. The darker yellow color of a buffed rolled 70/30 brass is never quite achieved.

Effect of Potassium Hydroxide

Potassium hydroxide was gradually increased from 0 through 5 oz./gal. in a solution of otherwise standard composition. Flat test panels were run at 30 amp./sq. ft. and 100°F. and color of brass deposited noted. Results are shown in Table 2.

TABLE 2

Effect of Potassium Hydroxide on Color of Brass Deposit

Potassium Hydroxide oz./gal.	Color of Brass
0	pink
1	slight pink
1.5	yellow with tinge of pink
2.0	good yellow
2.5	yellow with tinge of pink
3.0	slight pink
4.0	pink
5.0	pink

Results indicate potassium hydroxide concentration should be maintained at close to 2 oz./gal. Changes in temperature and free cyanide concentrations may offset the effects of too high or too low a potassium hydroxide concentration so that yellow deposits may be obtained somewhat below 1.5 oz./gal. and above 2.5 oz./gal. concentrations.

Efficiency

To obtain some idea of the cathode efficiency of the solution, weighed flat steel test panels were run in a solution of standard compositions. Anodes were placed

on each side of the panel and the same geometric pattern maintained throughout the tests. Plating time was 10 minutes at 20 amp./sq. ft. Current was accurately measured and maintained with a rheostat-ammeter arrangement. Time was determined using a stop watch. Efficiency was calculated in the following formula using the estimated electrochemical equivalent in grams per ampere hour for 80% copper/20% zinc alloys as obtained from the chart given by Graham,⁷ compared with grams per ampere-hour obtained in the present tests. E represents efficiency in per cent and W the grams per ampere hour. 80% copper/20% zinc figures were used since they represent typical analyses of the brass deposited under optimum conditions.

$$E = \frac{W}{2.14} \times 100$$

Table 3 shows results for E at various temperatures. At least four panels were run for each temperature.

TABLE 3
Cathode Efficiency of Brass Solution
at Various Temperatures

Temperature	Average Efficiency	Average Deposit Thickness
100°F.	23.1%	0.00013"
120°F.	46.3%	0.00020"
180°F.	82.4%	0.00033"

Efficiency is greatest at the higher temperatures although, unfortunately, the color of the deposit at this temperature is no longer yellow. No other efficiency tests were run; however, plate thickness tests of the various panels made it possible to closely estimate the efficiency using the thickness readings in Table 3 as a base. Thus, a lowering of the free cyanide from the standard level of 5.5 oz./gal. to 4.5 oz./gal. at 120°F. (Table 1) increased the efficiency to approximately 57%. Efficiency may be further increased by raising the temperature, taking care not to fall in the pink color range. Probable efficiency in commercial installations is 40-60%.

Effect of Copper/Zinc Ratio

A series of brass solutions were prepared in which all constituents were held constant at concentrations prescribed for the standard make-up outlined earlier except that the copper metal concentration was varied to produce changes in copper/zinc ratio. Usual steel test panels were plated 10 minutes at 20 amp./sq. ft. Effects were noted at 120°F. and 180°F. Results appear in Table 4.

Results indicate that the copper/zinc ratio can vary over a fairly wide range without seriously affecting color or plate thickness at 120°F. A recommended safe range is from 2.5:1 to 3.5:1. As expected, the high temperatures gave pink deposits with all ratios, with the exception of 2:1, which was a bright yellow. Operation at the high temperature with this ratio would not prove practical commercially, however, unless the solution could be closely controlled, since a small change in the ratio would result in pink deposits.

Effect of Carbonate

In both laboratory and commercial installations of the optimum high speed brass formulations, a rapid build-up of carbonates was observed, resulting from the decomposition of the cyanide salts. Table 4 shows effect of increasing the potassium carbonate concentration from 0 through 40 oz./gal. Solution was of the standard composition. Temperature was held at 120°F. current density at 20 amp./sq. ft., time was 10 minutes. Hull cell tests were at 1 ampere for 10 minutes.

Results indicate that no serious difficulties from carbonate build-up can be expected until carbonate concentration exceeds 10 oz./gal. Actually, many commercial solutions have operated satisfactorily with respect to color and thickness although carbonates had increased to 45 oz./gal. The chief objection to very high carbonate is the difficulty in dissolving additions in the solution which is highly concentrated in chemicals.

Sludging also occurs more readily, particularly when the solutions cool. Analysis of the sludge residues showed it to consist mainly of potassium zinc cyanide complex which is less soluble than potassium carbonate. Therefore, it becomes difficult to keep a sufficiently

TABLE 4
Effect of Copper/Zinc Ratio on Color & Thickness of Brass Deposit

Ratio Copper/Zinc	Temperature	
	120°F.	180°F.
2/1	Yellow	Yellow—brightest of all panels Thickness—0.00030"
2.8/1	Yellow Thickness—0.00014"	Pale Pink Thickness—0.00037"
3.28/1	Yellow Thickness—0.00019"	Pink, almost copper color Thickness—0.00037"
4.0/1	Pale Pink Thickness—0.00020"	Pink, almost copper color Thickness—0.00036"
6.0/1	Pink Blistering	Pink, almost copper color Thickness—0.00036"

TABLE 5
Effect of Carbonate on Color & Thickness of Brass Deposit

Potassium Carbonate oz./gal.	Color	Thickness	Hull Cell Panels
0	Yellow	0.00020"	Yellow 0-60 amp./sq. ft.
2	Yellow	0.00020"	
4	Yellow	0.00020"	Yellow 2-40 amp./sq. ft.
8	Yellow-streaked	0.00021"	Yellow 5-60 amp./sq. ft. Yellow-pink below 5 amp./sq. ft.
10	Yellow-streaked	0.00021"	
20	Yellow, very faint pink tinge	0.00021"	Yellow at high current density, gradually very faint pink toward lower current densities.
40	Pink, blistering		As above

high zinc concentration in the solution when the carbonate is extremely high.

Carbonate Removal

Usual freezing methods of removing carbonate are not applicable, due to the high solubility of potassium carbonate. Freezing the solution yields a precipitate consisting chiefly of zinc salts. Use of barium or calcium hydroxide is unsatisfactory due to excessive potassium hydroxide which is produced, and which causes the deposit to turn pink. Barium cyanide is a possibility, although excessive free cyanide may be formed which affects the efficiency of the solution.

Calcium sulfate⁸ has been tried in both laboratory and field solutions with apparent success. Although potassium sulfate is formed, it is much less soluble in the solution than potassium carbonate and much of it will precipitate when the solution is cooled. In an actual field test, about 6 oz./gal. potassium sulfate remained in solution although 8 oz./gal. was originally formed. The sulfate in solution does not appear to cause any serious trouble in the operation of the bath. Carbonate content need not be reduced much below 10 oz./gal.

Notes on Commercial Operation

MAINTENANCE AND CONTROL:

Occasional activated carbon treatment and low current density electrolysis are recommended to maintain the solution in good operating condition and new solutions must be purified thus. Filtration is recommended for a new solution; however, continuous filtration has not been found necessary in commercial installations.

Equipment required is not elaborate but is somewhat more extensive than normally used with conventional brass solutions. Steel tanks are recommended with steel or iron heating coils and temperature regulators. The latter are very important, since the temperature must be closely controlled if uniformity of color and thickness of plate are to be had. Cathode rod agitators may be used, especially if higher current densities are desirable. However, the solution may be used without agitation and most solutions are operated in this manner.

With reference to electrical equipment, controlled 6 volt direct current of sufficient current capacity power is satisfactory. Tank voltages should be on the order of 3 to 4 volts. In attempting to use equipment former-

ly used for conventional brass solutions, attention should be given to current capacities of bus bars and racks. Many such racks were designed for work at 3-5 amp./sq. ft. With the higher currents used in high speed brass plating, heavier conductors are required throughout. Firmer contacts, preferably spring type, are also recommended.

Analytical control is important, particularly the free cyanide and potassium hydroxide concentration which along with temperature influence color and thickness the most. Daily checks of these constituents are recommended. For the free cyanide, the method of Heiman and McNabb⁶ is recommended. This method for accurate results requires the determination of zinc. However for daily control purposes the zinc content may be assumed to be at the recommended levels and the titration obtained considered to be "free" cyanide. The "free" cyanide so considered should be held at 9 to 10 oz./gal. concentrations. The analytical procedure is as follows:

- (1) Pipette 10 ml. sample of brass solution into 250 ml. Erlenmeyer flask.
- (2) Add 20 ml. of 20% sodium hydroxide solution, 20 ml. of 10% potassium iodide solution, and 40 ml. of water.
- (3) Titrate with standard 0.1 N silver nitrate to a faint turbidity.

Calculations

*"Free" potassium cyanide in oz./gal. = ml. 0.1 N $\text{AgNO}_3 \times 0.174$ (Call this value A).

Determine zinc content.

Zinc content in oz./gal. $\times 3.98 = \text{KCN equivalent to } \text{K}_2\text{ZN}(\text{CN})_4$ (Call this value B).

Free potassium cyanide = A - B.

*"Free" cyanide = free KCN + KCN equivalent to the $\text{K}_2\text{ZN}(\text{CN})_4$.

For the potassium hydroxide the ordinary acid titration methods, using Sulfo-Orange indicator, are satisfactory.

The zinc, copper, anti-pit, brightener, and potassium carbonate constituents should be checked from time to time, although fairly wide variations are permissible without serious effects on the deposit. Since the solution is not operated as a bright solution, the sodium thiocyanate concentration has not been found to be critical.

Commercial installations have operated satisfactorily for many months without additions of sodium thiocyanate. The same situation was found to prevail for the anti-pit, the chief requirement being that sufficient be present to suppress fumes and prevent pitting.

The solution need not be controlled by observations of pH since the potassium hydroxide titration gives satisfactory results for alkalinity. For a solution in good operating condition, the pH was observed to be 13.0-13.5.

Unlike conventional brass solutions, additions of ammonia are not required for control of color, although it has been observed that, in some cases where the deposits were on the pink side, ammonia did restore the desirable yellow. Ammonia is no doubt formed in the solution due to the decomposition of the potassium cyanide and ordinarily sufficient is present to assist in maintaining the yellow color.

ANODES:

Cast 80% copper/20% zinc anodes have been used in either ball or oval shapes in most field installations. Rolled anodes should also be satisfactory, although they have not been tried. To minimize sludge formation, anodes should be manufactured from high purity metal. Anodes must not be bagged.

For best results, anode current densities should be kept below 20 amp./sq. ft. which means that, if the cathode current densities of up to 40 amp./sq. ft. are contemplated, an anode to cathode ratio of 2 to 1 should be maintained. High anode current densities may cause anode film and sludge formation which may disseminate through the solution, causing roughness. Anode film polarization may also lead to increased consumption of potassium cyanide.

THROWING POWER AND CURRENT DENSITY:

No formal laboratory tests were made of throwing power; however, observations in the field on a wide variety of recessed parts showed the solution to possess high throwing power. Even remote recessed areas were well covered and the color maintained.

For average operations to date, the best results have been obtained at average current densities of 20-30 amp./sq. ft. For faster plating on certain parts, current densities of 40 amp./sq. ft. or higher may be used although, under such conditions, closer attention must be paid to anode current density, agitation, filtration, and racking. No significant differences in the color of deposits was noted in the current density range of 2 to 40 amp./sq. ft.

PLATING CYCLES:

Steel is the metal generally plated and the usual cleaning and pickling cycles are satisfactory for preparing the base metal. No strike is required — the high free cyanide reduces any tendency of the solution to deposit by immersion so that parts may be directly plated without adhesion difficulties.

After plating, the parts should be thoroughly rinsed

in cold and warm rinses. Failure to do so may lead to staining or spotting, especially on parts where the base metal is rough or in otherwise poor condition. In some operations where spotting has been a problem, the cycles include an acidified sodium dichromate dip followed by thorough rinsing. Use of water displacement compounds as a final dip after water rinsing also aids in producing stain free surfaces.

BARREL PLATING:

One of the more promising applications of the high speed brass formulation is in barrel plating. Several production solutions are in successful use. Composition of the barrel solution is the same as the still solution except no anti-pit is required. Operating temperatures are 95-110°F. Applied voltage is from 4 to 7 volts. Above 7 volts deposits may become white and, if 12 volts are used, deposits are almost always white. Deposition rates are high and 0.0008" or heavier in 45 minutes is not an uncommon rate. Thicknesses suitable for buffing are achieved in relatively short times, although barrel plated parts need not be and usually are not buffed. The barrel solution exhibits exceptional ability in throwing into deep recesses. Such parts as tube lipstick containers were readily covered inside and out with a deposit of uniform color.

Conclusion

In conclusion, based on laboratory and field experience, it is felt that the high speed brass plating solution using potassium salts has a definite application where buffed brass plate can be used as the final finish. Some commercial applications have been ladies' handbag hardware, luggage, leather goods hardware, cosmetic containers, and similar parts fabricated from steel. The solution also has possibilities where a fast brass plate is desirable whether buffed or not, as in barrel plating. While the solution operates satisfactorily over a fairly wide range of conditions, reasonable maintenance and control are essential.

The author wishes to express appreciation to A. Brazauskas of the *Apothecaries Hall Co.* laboratory staff for his assistance with the laboratory work and to the members of the *E. I. DuPont de Nemours & Co.*, Electrochemical Department for their helpful comments.

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Electroless Plating Comes of Age

By Dr. Abner Brenner, Chief, Electrodeposition Section, Division of Chemistry, National Bureau of Standards, Washington, D. C.

This is the second and final installment of the article. Part I and all the references appeared in our November issue.—Ed.

Equipment for Electroless Plating

MATERIALS OF CONSTRUCTION OF TANKS:

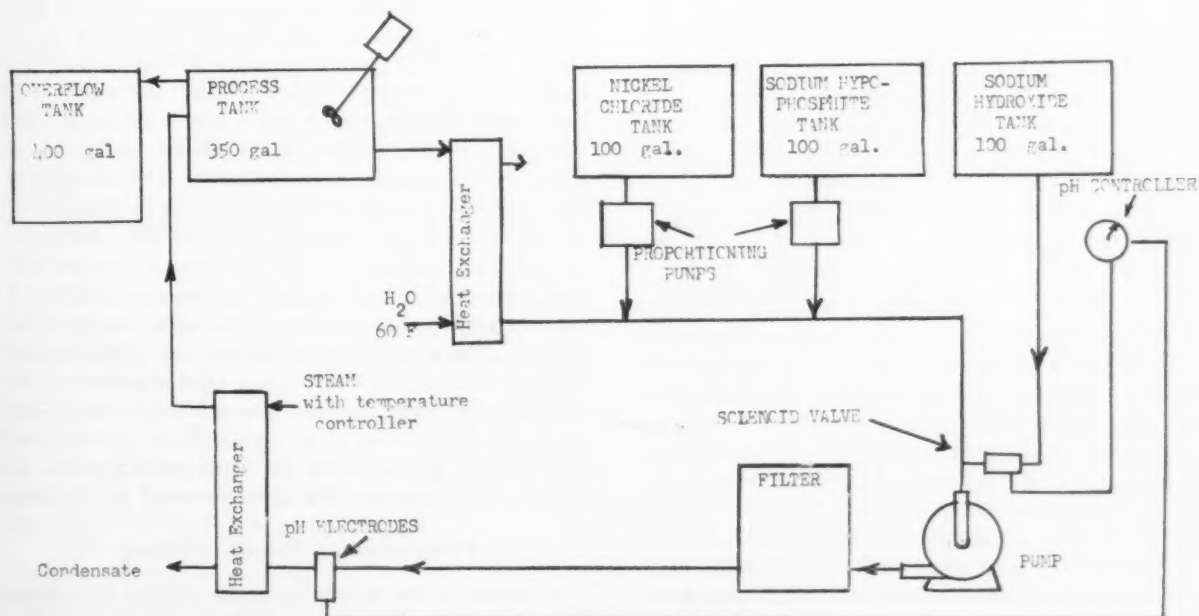
Some of the characteristics of electroless plating make the selection of suitable materials for equipment rather difficult. Since the bath is operated at almost the boiling point and is sensitive to impurities, the plastics which may be used for containing it are limited. Furthermore, since some nickel eventually deposits on the walls of the container and equipment, the latter must be capable of being cleaned without damage either mechanically or with nitric acid. A survey of both laboratory and commercial practice disclosed that no wholly satisfactory vessel for containing the solution has been developed although many different materials have been tried. Steel tanks have been coated with the proprietary plastic compositions "Permolite";^{10, 28, 32} with "Chempro 1077"²⁷ which is a modified phenolic plastic²⁸; or

with "Heresite."³⁶ The latter is said to be one of the best materials evaluated.³² One company³⁷ tried a number of different tank materials including Lucite and various enamel linings, but found Permolite most economical. Following a two week period of operation, the tank was emptied and the nickel scraped from the walls. This abraded the lining, so that one application lasted for only 5 cleaning cycles. In some instances the linings were put over carbon steel, in others over stainless steel tanks. The latter would be preferable in view of the need of cleaning the tanks occasionally with nitric acid, so as to eliminate attack of the tank through defects in the plastic coatings.

The Eastman Kodak Co.²⁸ recoats tanks with Permolite 11A. Accumulations of nickel are removed as far as possible and then two coats are applied over the old coating. Curing is hastened by banks of infrared lamps.

*Product of Heresite and Chemical Co., Manitowoc, Wis.

^{**}Product of Chemical Proof Construction Corporation, Downey, Cal.



Courtesy of General Electric Co., Aircraft Gas Turbine Division, Cincinnati, Ohio

Figure 3. Diagram of layout for electroless plating.³⁸

or by circulating hot air at 200°F. The coating must be thoroughly cured or it may be attacked by the bath.

Other types of tanks used involve ceramic materials or glass in the form of glass jars,³⁵ porcelain vessels,²⁷ plastic-impregnated fiber glass,^{28,34} or glass-lined steel vessels.^{10,13,14,40} The glass and glass-lined vessels are preferable for small-scale operation. Polyethylene liners have been used in steel tanks²⁷ and have not proved completely satisfactory. The liners must be extracted with boiling water before use to avoid organic impurities. On a laboratory scale, the author has used polyethylene liners and polyethylene vessels without difficulty by suspending them in a water bath. Even wood has been used as a tank material.²⁸ Lucite has been tried for tanks and found unsatisfactory, but it was not stated whether the ordinary or the high-temperature form was used.

According to West,¹⁴ high-temperature Lucite is a suitable material for constructing electroless plating barrels, as is also polystyrene, although the latter must be carefully handled since it is rather brittle. He warns against the use of rubber-coated metal.

Since new plastics continue to appear on the market, it is likely that the problem of a chemically resistant tank or tank lining for electroless plating will soon be solved. However, the complete elimination of nickel deposition on tanks is problematical. Among the more promising new materials are a fluorinated plastic laminated with other plastics so that it may be heat sealed to form liners. Polyethylene has been converted into a form which retains its rigidity at elevated temperature by radiating it with x-rays.

AUXILIARY EQUIPMENT:

In addition to tanks, other equipment common to electroplating is required for electroless deposition, such as filter pumps and heat-exchangers. Installations for heating the baths vary considerably. Some operators simply heat the bath with an electric immersion heater, or with steam coils immersed in the baths. In the better engineered set-ups, baths are heated by a hot water jacket or by a heat exchanger. An important precaution is that local overheating be prevented, or else decomposition with precipitation of nickel will occur at that spot and may lead to a spontaneous decomposition of the bath. This may also happen when steam coils are immersed in the bath, as a considerable build-up of metal may occur on them and initiate decomposition of the bath. However, in some installations,^{28,32} bare stainless steel coils are used for steam.

Continuous filtration of the bath is desirable, since dust and other suspended material may initiate the spontaneous reaction, and the particles, after becoming coated with nickel, still further augment the deterioration of the bath. However, only a few of the installations have provided continuous filtration, preferring to dump the solution more often. Since the hot solution will deposit nickel on the particles removed by the filter, the solution must be cooled before filtering, and then it must be brought up to temperature before entering the bath. This requires the use of heat exchangers, which are practical, however, only for large installations. The engineering required for electroless plating

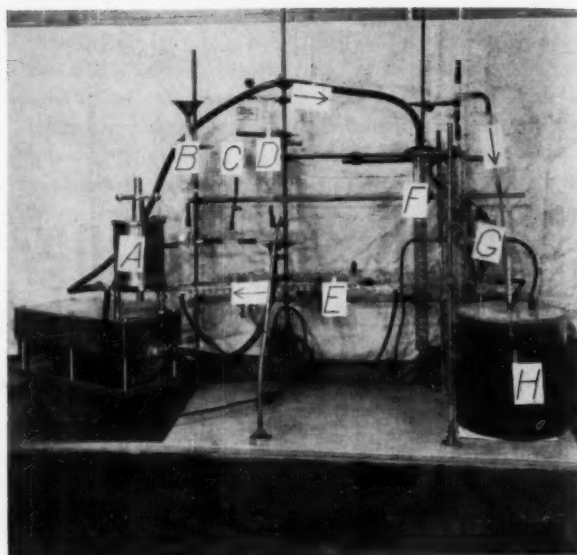


Figure 4. Laboratory setup for electroless plating.³⁸ Courtesy of General Electric Co., Aircraft Gas Turbine Division. A is filter and pump; B, funnel for addition of nickel chloride solution; C, delivery-tube for sodium hydroxide; D, funnel for addition of hypophosphite solution; E, heat exchanger for cooling solution before making additions; F, heat exchanger for heating solution; G, stirrer; H, plating tank. Solution is cooled below 140°F. before making additions and filtered before being heated to 190°F. for plating.

is discussed in the bulletins of the Metal Processing Co.¹⁰ (see also ref. 8).

An installation similar to that described by them is operated by General Electric.³⁸ A diagram of this layout is shown in figure 3, and a laboratory set-up embodying the essentials is shown in figure 4. This process has been used by General Electric since 1950. The diagram shows that the bath leaves the plating tank and is then cooled with a heat exchanger to about 140°F. The various additions are then made to the bath. Alkali is added automatically by a pH controller-recorder. The rates of flow of the make-up solutions are controlled by flow meters under a gravity feed. It will be noted that the make-up solutions are added before the solution reaches the filter pump to prevent precipitated hydroxide from entering and decomposing the bath. After passing through the filter, the solution is brought up to temperature by a heat exchanger. The additions to the bath increase its volume and the overflow goes into another tank. When the overflow tank is full, the process tank is worked until it is depleted of nickel, at which time it is dumped and the solution in the overflow tank utilized as the bath. A similar two-tank system with filter is used by Eastman Kodak. A heat-exchanger and a filtering system is also used by General American Transportation and Philadelphia Rust-proof. Since particles of any kind may decompose the bath, the Metal Processing Co.¹⁰ recommends that the baths be covered at all times. Their installations also provide for agitation in the processing tank, as this is said to improve the appearance of the deposit.

Pretreatment Before Plating

A survey of the reports from the various companies contacted showed that only ordinary cleaning procedures such as those used for electrodeposition were necessary before immersing the work in the electroless

plating bath; therefore, this subject does not need to be discussed in detail. Apparently none of the operators were having trouble with adhesion of the deposit. West^{13,14} states that an electroless deposit may be returned to the bath and plated again without peeling or blistering of the subsequent deposit. The adhesion of the deposit to steel was found to be in excess of 50,000 lb./in.²^{6,12} Although adhesion has not been a problem in the commercial operation of the process, the author has found that obtaining satisfactory adhesion on high-carbon steels and on non-catalytic surfaces that have been activated with palladium is more difficult than obtaining adhesion on low-carbon steel. The Chemplate Corp.³⁶ mentions adhesion problems with steel alloys, such as 4340, and high molybdenum tool steels.

Bath: Composition, Purification, Life and Plating Rate

COMPOSITION:

Most of the commercial electroless plating baths were of the acid type, although two companies having small installations were using the alkaline type of bath.^{35,40} The compositions of the acid baths varied mainly with respect to the type of organic acid used as a buffer and/or complexing agent. In some, hydroxyacetate was used; in others, citrate or a mixture of citrate and acetate. One or two companies mentioned improvements in the composition of the bath that they were not at liberty to reveal. Patents cover the use of several of the aliphatic dibasic acids, as already discussed above, with particular emphasis on succinic acid. Eastman Kodak²⁸ used sodium citrate, 5 g./l. and sodium acetate 5 g./l.

Judging from the letters which have been received at the National Bureau of Standards, some people have experienced difficulty in finding a source of sodium hydroxyacetate. The salt need not be purchased or used as such. In preparing the bath, hydroxyacetic acid solution, which is a cheap commercial chemical,* is diluted and neutralized with caustic soda. The resulting solution is used directly in preparing the bath. In the original work on the process at the Bureau, we used a purified grade of hydroxyacetic acid which was obtained from Dupont in the form of white crystals. Apparently this is no longer manufactured. We found that the technical 70% solution yields a lower rate of deposition and contained impurities of copper and iron.

Brighteners or other addition agents were not used to any extent in the bath, as the deposits normally come from the bath semi-bright. A small amount of gelatin has been used in the hydroxyacetate bath to improve brightness of the deposit.³⁷ It had been reported that the ordinary nickel brighteners were effective in the electroless plating bath. We did not make an extensive study of the subject, but found that good results were obtained with the first brightener tried.

PURIFICATION:

With one exception,³⁵ all the companies prepared

*E. I. Dupont de Nemours Company, Wilmington, Delaware.

their baths from commercial salts. In some instances, purification of the solutions was necessary to remove impurities associated with the commercial nickel salts. Lead, iron, copper, and cyanide were cited as impurities that should not be permitted in the bath, the cyanide being the most potent poison.²⁸ Several advocated the removal of copper, iron, and other impurities by low-current density electrolysis.^{27,28,37} one company²⁸ advocating at least 10 ampere-hours per gallon of bath. Other methods of purification suggested were the use of hydrogen sulfide for removing copper and the use of hydrogen peroxide for aiding in the removal of iron. North American Aviation, Inc.²⁷ prefers a hydrogen sulfide precipitation to electrolysis. In working with small baths, the author has found that, after they have become poisoned, they cannot always be rejuvenated, even by low-current density electrolysis or by use of activated carbon. Eastman Kodak²⁸ finds that labor costs do not justify purification and, therefore, takes precautions to avoid contamination of baths.

LIFE OF THE BATH:

The economics of electroless plating are directly concerned with the life of the bath and the rate of plating. The latter is probably the more important economic factor since it determines the output of work with a given investment in equipment. The length of time that a bath can be used is less important because the bath is actually rather dilute in nickel and other salts and occasional dumping does not represent a very large loss of chemicals. The largest financial loss would be the time required to prepare a new bath. In the following paragraphs the operating life of the baths will be discussed first, and this will be followed by a discussion of the rate of plating.

The useful life of an electroless bath is not measured in hours. A bath stored at room temperature or simply heated in the absence of catalytic material will last indefinitely, so that the permanency of the bath with respect to time per se is not a criterion of its performance. The only satisfactory economic basis for evaluating the life of a bath is with respect to the amount of nickel which has been deposited from the bath. This may also be evaluated, somewhat less directly, from the amount of hypophosphite which has been utilized by the bath.

The life of baths reported by different plants vary considerably. In three instances baths were dumped after a rather short period of operation, although the baths were still in operating condition. This was considered preferable to running the risk of encountering difficulties which would slow up production.^{13,33,40} One company discarded the bath after 8 hours,¹³ and another after 3 days of operation. The longest utilization of a bath was reported by the Allison Division, General Motors Corp.,³⁷ which utilized 200 to 300 grams of sodium hypophosphite per liter over a period of 30 days. This would be equivalent to depositing about 45 grams of nickel per liter of solution, which would require the replenishing of the original nickel content of the bath probably five times. Philadelphia Rust-Proof,³² operated a bath for a week with two shifts per day, during which time a coating of nickel 0.4 mil thick was deposited on 200,000 in.² of surface. For the size

of the tank used, this is equivalent to depositing about 22 grams of nickel per liter of solution. The Kanigen process is said³⁴ to permit the deposition of nickel equivalent to three times the original nickel content of the bath. Eastman Kodak²⁸ used a bath from three to six weeks during which time 120 g./l. of sodium hypophosphite was used and the nickel deposited was estimated to be about 15 g./l. of bath. To summarize, the utilization of the baths is limited to between 10 and 30 g./l. of nickel. The life of the bath does not seem to have any theoretical limitation, as the end products of the reaction are inert and should crystallize out when the bath becomes saturated with them. The deterioration of the bath must be attributed mainly to the build-up of impurities.

RATE OF DEPOSITION:

Next to the cost of chemicals, the rate of deposition of nickel is probably the most important economic factor governing the use of the electroless process. As pointed out in the general part of this report, the rate of deposition of nickel from the acid electroless bath is not very much affected by the concentration of either nickel or hypophosphite, whereas the rate of deposition from the alkaline bath is proportional to the hypophosphite concentration. Therefore, the latter bath offers greater opportunities for higher rates of deposition. According to patents,^{19,20} the rate of deposition can be increased by having a certain ratio of nickel to hypophosphite in the acid bath and by using certain organic acids such as succinic acid.

The fastest rate of deposition was reported by G. M. Kellar³³ who, on a laboratory scale, obtained a rate of deposition of from 1 to 3 mils per hour with an alkaline bath containing about 50 g./l. of sodium hypophosphite. This is a rather high concentration, and the bath would be subject to spontaneous decomposition. The rate of deposition by the Kanigen process is reported as about 1 mil per hour with special solutions available which yield a rate of 2 mils per hour.³⁴ Most of the other companies which are operating on a production basis reported rates of deposition ranging from 0.2 to 0.8 mil per hour, with the lower rates of deposition more common.

One of the difficulties encountered is that the rate of deposition of electroless nickel is initially high in a fresh bath but rapidly drops off as the bath is used. For example, Eastman Kodak²⁸ reported that their bath, which was made up with sodium acetate and sodium citrate, frequently had an initial rate of deposition of about 1 mil per hour but, after the bath was used for a day, the rate dropped to about 0.1 to 0.2 mil per hour. A similar experience was mentioned by the Allison Division, General Motors. A new bath made up with hydroxyacetate plated initially at the rate of 0.6 mil per hour, but the rate dropped rapidly to about 0.4 mil per hour and stayed at this figure for some time. The bath was discarded when the rate fell below 0.2 mil per hour. The cause of the drop in plating rate on continued operation of the bath would seem to be an important subject for further research. Recently Eastman Kodak²⁸ found that the falling off in rate was due to the loss of acetic acid. This was remedied by

adding sodium acetate to the bath at the rate of 1 g./l. per 8 hours of operation.

SPONTANEOUS DECOMPOSITION:

Occasionally the life of an electroless plating bath comes to an untimely and sudden end through spontaneous decomposition. This phenomenon begins first with a mild, uniform evolution of gas throughout the volume of the bath instead of only on the surface of metal parts. The gassing becomes more vigorous, the solution begins to froth somewhat, and a black precipitate appears in the bath.

Finally the gas evolution becomes so vigorous that the entire contents of the vessel foam over. Only a few companies reported difficulty with spontaneous decomposition, and usually the source of the trouble could be traced and the threat removed. One company⁴⁰ followed the procedure of adding hydrochloric acid to the bath to stop deposition if general gassing was observed throughout the bath. Spontaneous decomposition of the bath can be initiated by many causes, such as local overheating, adding hypophosphite so rapidly so as to cause a high local concentration, adding alkali so rapidly as to cause local precipitation of nickel compounds, and presence of too much nickel deposit on tank walls or on heating coils. In one instance, spontaneous decomposition of a bath occurred while it was being made up because the pH became high enough to cause precipitation of nickel compounds. Eastman Kodak²⁸ found that baths were more liable to spontaneously decompose when new and adapted the procedure of operating a new bath at about 180°F. for the first one or two days. Another source of spontaneous decomposition is the use of a palladium dip as an activator for non-catalytic surfaces. Even though the objects to be plated are thoroughly rinsed after dipping, they still seem to initiate spontaneous decomposition of the bath. Therefore, the contact method of initiating deposition should be used wherever applicable, or still better, a separate strike bath should be used if the palladium pretreatment has to be employed. Spontaneous decomposition seems more likely to occur with chloride than with sulfate solutions and is more likely in acetate-buffered baths. According to the General American Transportation patents,²⁰ the use of dibasic acids such as succinic acid stabilizes the bath.

Operating Conditions

The pH values of the acid baths are all in the range of 4 to 6. It was the general opinion of the companies surveyed that the rate of nickel deposition decreased below this pH. The lowest pH reported was 3.4 although the best results were stated as being obtained at 4.0.¹³ Most operators apparently keep the pH between 4 and 5.

The rate of deposition is very sensitive to the temperature of operation. At elevated temperatures the rate about doubles for each ten degrees Centigrade rise of temperature.^{10,27} The most common temperature of operation of electroless baths was 195 to 200°F. One company stated that above 200°F. the tendency toward spontaneous decomposition was greater. However, it is doubtful that a definite critical temperature exists.

Agitation of the bath was considered necessary by some operators. This would be particularly necessary to prevent stagnation and depletion of solution in recesses. Agitation of the solution is known to increase the rate of deposition from the acid electroless bath but not from the alkaline bath.²

Replenishing the bath with nickel salts and hypophosphite was done intermittently in most installations, at periods ranging from a few hours to a day. In most cases the replenishing solutions were added directly to the operating tank, but this is not a safe procedure. A necessary precaution noted by some operators was that the replenishing solutions should be filtered. The best arrangement for replenishing the bath was that of General Electric.³⁸ The solutions of nickel and hypophosphite were continuously added to the cooled bath before it passed through the filter pump.

Deposition on Noncatalytic Surfaces

It is well known that only certain metals catalyze the deposition of electroless nickel upon their surfaces. In our published work² we showed that plating could be initiated on noncatalytic metals by certain techniques. One of these consisted simply in touching the specimen with a piece of metal, such as aluminum, which was actively plating in the solution. Another procedure involved immersion of the specimen in a hot palladium chloride solution containing from 0.01 to 1.0 gram of palladium per liter, rinsing and then introducing into the acid electroless plating bath.

Apparently an extremely thin film of palladium was formed on the surface of the metals, perhaps only one atom thick. However, this film was sufficient to initiate deposition of nickel, which after once starting continued because of the catalytic nature of nickel. Certain metals cannot be activated even by these techniques. They are bismuth, cadmium, tin, lead and manganese.²⁰ Such metals, of course, can be copper plated and then pretreated or preferably²⁸ given a preliminary coating of electrolytic nickel. Active metals such as aluminum and magnesium can be plated by the electroless process. It cannot be determined whether these metals are actually catalytic or whether deposition is initiated through formation of an immersion deposit of nickel on their surface by chemical replacement.

Subsequent to the publication of our papers in 1947, several laboratories found that nickel could be deposited on glass and plastics by the electroless process. This procedure is to be differentiated from the spontaneous, noncatalytic type of reaction, such as that of Roux,²³ which indiscriminately deposits a film of nickel over everything immersed in the solution, including the walls of the container, and results in the complete impoverishment of the solution. N. Hackerman³¹ found that glass which had been etched with hydrofluoric acid received a deposit of electroless nickel. Also, glass or plastics which had been heated in a vacuum and not exposed to air received a deposit. Exposure to air resulted in a nonadherent or powdery deposit.

P. Baeyens³ described a method for producing a coating of electroless nickel on glass and plastics. The procedure is a combination of that used for sensitiza-

tion of surfaces for making mirrors and of the palladium dip, mentioned above for pretreating noncatalytic metals. The object is first sensitized in a solution of stannous chloride, then immersed in a solution of silver nitrate, and finally in a hot solution of palladium chloride. The objective is to cause palladium to be adsorbed on the surface. Thorough rinsing is done after each step. On immersion of the specimen in the hot electroless plating bath, deposition of nickel begins within a few seconds. Complete details are not available since a patent is being applied for. Figure 5 is from P. Baeyens²⁶ and shows the relation between temperature, concentration, and time for sensitization in the palladium dip. An elevated temperature is conducive to sensitization. Similar observations on plating glass and plastics have been made by others. General American Transportation has exhibited plastics which were plated by the electroless process, but the details have not been revealed yet.

In repeating the work of Baeyens in our laboratory, we found that the use of the silver nitrate solution is not necessary. If the glass or plastic is first immersed in a solution of stannous chloride of sufficient strength, for example 10 percent, the object may then be placed in a cold palladium chloride solution, 1.0 g./l., to complete the activation of the surface. A solution of hydrazine may be used in place of stannous chloride, and presumably other reducing agents can be used as well. In some instances a wetting agent in the solution of the reducing agent improved the results.

The deposit on glass is bright and adherent. It is considerably more adherent than the silver film obtained by the usual chemical reduction methods, as it cannot be scraped from the surface with the finger nail. In coating plastics such as Bakelite, Lucite or Nylon, the surface must be roughened to promote adhesion. The vapor blast is very satisfactory for this purpose. The adhesion of the coating to plastic is not nearly as tenacious as to glass, and further research will be required to improve it.

Whether the electroless process for nonconductors will be competitive with the methods now using the reduced silver or copper films seems problematical. The process would have the advantage of turning out a satisfactory coating in one operation without requiring the use of electrical contacts for electrodeposition as must be provided following the silver or copper-film methods. However, the tendency of electroless baths to spontaneously decompose when used on objects subjected to the palladium pretreatment presents a problem.

Electroless Deposition of Other Metals

Since nickel and cobalt can be deposited in a useful form by the electroless process, many have felt that the deposition of other metals, particularly chromium, by the same methods would be very desirable. Thus far, no other successful electroless plating process based on hypophosphite has been announced, and, therefore, it is of interest to explore the possibilities. Salts of many of the less active metals, such as silver and palladium, are reduced to the metal by hypophosphite, but the reaction is of the spontaneous type and produces

a mossy precipitate, not a plate. A successful electroless plating process must be catalytic so that deposition occurs only on the surface of the object and not spontaneously through the solution and, for the process to be catalytic, the metal to be deposited must be capable of decomposing hypophosphite. A simple way of checking whether a metal is catalytic is to determine if it will receive a nickel deposit in the electroless bath without the use of any special activating treatments. If the metal will not, then it is very unlikely that this metal itself can be catalytically reduced by hypophosphite.

As pointed out previously, the metals which directly receive an electroless nickel deposit are limited to a small number, among which are iron, platinum, palladium, rhodium, gold and, under some special circumstances, silver and copper. In the author's laboratory, some exploratory experiments were made on the deposition of rhodium and palladium by the electroless process. Deposition of palladium was partially successful. The main difficulty was in obtaining a deposit of appreciable thickness without causing spontaneous decomposition of the solution. Deposits of palladium about 0.1 mil thick were obtained from a hypophosphite solution buffered with formate. These solutions had only a short life.

A further limitation to the extension of the electroless process to other metals is revealed by the potential reached during deposition. The potential of a metal actively plating in the electroless nickel bath is about -0.65 volt² with respect to the standard hydrogen electrode. Metals which require a more electronegative potential than this for deposition cannot be deposited by reduction with hypophosphite. This eliminates the possibility of depositing active metals such as manganese or chromium by the hypophosphite process.

The possibility exists, of course, that other reducing agents can be used to bring about depositions that do not occur with hypophosphite. However, none of the more recent examples of chemical deposition seem to be definitely of the catalytic type. For example, a deposit of cobalt¹ is formed on the surface of a copper rod immersed at 150°C . in a melt consisting of a mixture of potassium formate and a cobalt salt. More recently, the deposition of cadmium by chemical reduction has been the subject of a preliminary study,⁴⁵ the results of which are not yet ready for publication. The deposition of titanium upon metals and ceramics can be accomplished by immersion in a fused salt bath containing divalent titanium compounds.⁴¹ These three reactions are all probably ordinary noncatalytic chemical reactions.

Economics of the Electroless Plating Process

A question which is frequently asked about the electroless plating process is its commercial feasibility. That subject will not be discussed here since it involves a number of factors, including cost of labor, equipment, and overhead, on which the author has no information. For special applications, no doubt exists that it is competitive with electrodeposition. The opinion has been offered³⁴ that the electroless process would be competitive with electroplating for coatings up to

1 mil thick. It is not clear whether this is meant for engineering or for decorative applications. The following treatment will consider only the costs of the chemicals required for the process.

The electroless plating bath is rather inexpensive to make up, as the cost of the chemicals amounts to only about 15 to 20 cents per gallon of solution. The bath contains about 10 cents worth of organic acid, 3 cents worth of nickel, and several cents worth of sodium hypophosphite. Usually the hypophosphite and nickel content of the bath can be virtually exhausted from a bath before it is discarded, so that the organic acid represents the main loss when a bath is dumped.

The real key to the economics of operating the electroless plating process is the cost of the hypophosphite. The hypophosphite bears to the electroless process the same relation that the electric current bears to electrodeposition; both are the means of reducing metal ion to metal. Therefore, the extent to which the electroless process will be competitive with electrodeposition will depend on the cost of hypophosphite. The utilization of hypophosphite by the electroless process is not very high, ranging from 20 to 37% of theoretical. If we assume an efficiency of 30%, then 6 lb. of sodium hypophosphite would be required to deposit 1 lb. of nickel, which makes the electroless nickel deposit rather expensive. Let us now examine the cost of sodium hypophosphite.

A pharmaceutical grade of sodium hypophosphite is available on the market for about 1 dollar per pound. The Oldbury Electrochemical Co., which early became interested in the process and has been supplying the bulk of the hypophosphite, offers a plating grade for about 50 cents per pound. In ton lots the price is 45 cents per pound. The future outlook for an appreciable decrease in price of the compound is not very good. The company states³⁰ that the costs of producing the plating grade of hypophosphite is actually close to that of the NF IX grade. They have offered the hypophosphite to industry at a relatively low price to stimulate the growth of electroless plating. A further reduction in the price is not likely to take place unless the consumption of the chemical reaches a higher figure, such as a thousand tons a year. Utilization of this amount does not represent a large volume of nickel plating. One thousand tons of sodium hypophosphite would deposit about 170 tons of nickel, which amounts to only a little over 1% of the 15,000 tons of nickel that were used in this country in 1948 for electroplating. Hence, a volume of electroless plating equivalent to 1,000 tons of hypophosphite per year should be attained fairly easily.

At a price of 45 cents per pound for sodium hypophosphite, the cost of salt used for depositing 1 pound of nickel would be 6×45 cents or \$2.70. This is roughly about 50 to 100 times the cost of electrical energy for the purpose. Electricity is a far cheaper reducing agent than any chemical. However, the cost of hypophosphite as a reducing agent seems abnormally high even when compared with other reducing agents which are products of the electrochemical industry. For example, the metals sodium, magnesium, and aluminum, at a price of 25 cents per pound would have the following costs, respectively, for each gram-

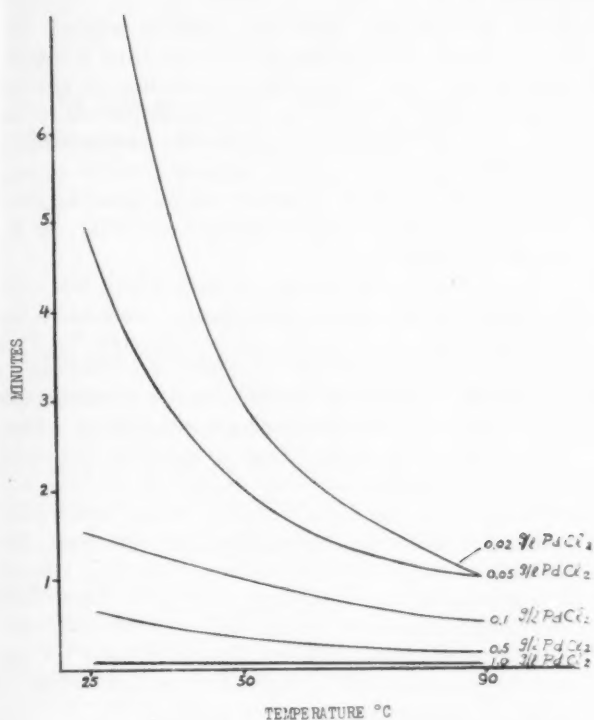
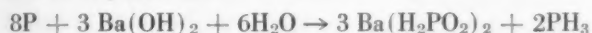


Figure 5. Conditions for obtaining activation of a nonconductor with a palladium chloride solution. Time of immersion and temperature of solution required for various concentrations of palladium chloride. Data from communication of P. Baeyens.²⁶

equivalent of reducing power: 1.3 cents, 0.7 cents, and 0.5 cents. The cost of a gram-equivalent of hypophosphite is approximately 5 cents or about five times or more higher. This is because hypophosphite is prepared by a multi-stage process from a relatively expensive starting material, yellow phosphorus, which sells at 20 cents per pound.

The initial stage in the preparation of hypophosphite consists in reacting yellow phosphorus, which is a product of the electric furnace, with an alkali such as barium hydroxide:



In this reaction, about one-fourth of the phosphorus is lost as phosphine, and doubtlessly side reactions occur. A method has been developed for oxidizing phosphine to hypophosphite with iodine.⁴⁶ This process is scarcely commercial, but it points the way to the possibility of increasing the yield of hypophosphite through obtaining a more complete conversion of yellow phosphorus.

The total cost of chemicals — including hypophosphite, organic acid and nickel — for depositing 1 lb. of electroless nickel is about \$4.00 per pound, which amounts to about 20 cents per square foot of coating one mil thick.

Determination of the Hypophosphite Content

Since hypophosphite ion is the active chemical in the process, the determination of its content in the bath is important. Too low a concentration may result in a low rate of nickel deposition, and too high a concentration may lead to a lower efficiency of utilization of the

compound and occasionally to spontaneous decomposition of the bath.

Several methods of analyzing for hypophosphite ion have been proposed. Since these methods are not described in most text books on analytical chemistry, they will be described in sufficient detail to enable one to use them without referring to the literature. As the bath contains both phosphite and hypophosphite, the determination of the latter is complicated. One standard method of determination involves the oxidation of hypophosphite ion with iodine. General Electric has developed a colorimetric method based on the blue color developed by reduction of molybdate with hypophosphite. A method recently developed by Oldbury Electrochemical is based on measurement of the time required for hypophosphite to decolorize a dye under certain conditions.

The iodine method of Wolf and Jung⁴⁷ will be described first since it is probably the most accurate method, although it is not sufficiently rapid for plant control. It is based on a difference in the rate of reaction of phosphite and hypophosphite with iodine in alkaline and in acid solutions. In a solution made alkaline with sodium bicarbonate, phosphite is rapidly oxidized to phosphate while hypophosphite scarcely reacts. However, hypophosphite reacts quantitatively with iodine in acid solution, while phosphite ion reacts only partially in an hour's time. The determination of hypophosphite in the presence of phosphite consists of two parts: (1) A mixture of the two ions is allowed to react with iodine in acid solution; the solution is then made alkaline, still in the presence of iodine, so that hypophosphite and phosphite are both oxidized completely to phosphate. (2) Another sample of the solution is oxidized only on the alkaline side, the phosphite alone being determined. From the difference between the consumption of iodine in the two titrations, the content of hypophosphite may be calculated.

These are the details of the procedure for phosphite as used by Oldbury Electrochemical:

A 50 ml. aliquot of the sample solution* is transferred to a 300 ml. iodine titration flask, 20 ml. of 5% $NaHCO_3$ added, and the flask and contents placed in the ice bath. When the solution is cool, 50 ml. of 0.1 N iodine solution is added, the flask stoppered securely, and allowed to stand at room temperature for at least two hours. At the end of that time the flask is again placed in an ice bath for 15 minutes before the stopper is removed. The solution is acidified with acetic acid and the excess iodine titrated with 0.1 N sodium thiosulfate solution, using starch indicator near the end point.

Calculation:

$$\frac{\text{Net ml. 0.1 N iodine} \times 0.0063 \times 1000}{\text{ml. of original solution in aliquot}} = \text{g./l. } Na_2HPO_3.$$

The titration of total phosphite plus hypophosphite

*Equivalent to about 10 ml. of an electroless plating bath.

is done next. A 10 ml. sample of an acid electroless plating solution is acidified with 10 ml. of 15% sulfuric acid and excess iodine is added. To complete the oxidation of hypophosphite, the vessel must be closed and allowed to stand 10 hours. The solution is then made alkaline with a paste of sodium bicarbonate to complete the oxidation of phosphite and the titration of excess iodine carried out as just described. For the acid oxidation the use of bromine may be preferred since it is somewhat more rapid than iodine. This is the method of assay of hypophosphites in the National Formulary. In all of these titrations an important precaution is that the solution be well cooled with ice to prevent volatilization of iodine. In making calculations it must be remembered that oxidation of the hypophosphite ion requires twice as much iodine as the phosphite ion.

Since the iodine method requires a considerable amount of time for completion of the reaction, a quicker method is desirable for control of the electroless plating bath. The following method was developed by Oldbury Electrochemical.³⁰ It is based on the measurement of the time required for hypophosphite to decolorize a dye solution. The stronger the hypophosphite solution, the shorter the time required. The relation between time and hypophosphite concentration is determined with known amounts of hypophosphite. The method is not precise but is considered satisfactory for control purposes.

The procedure is simple. A sample of the electroless bath is added to a solution of methyl orange. A solution containing sulfurous acid is then added and the stop-watch started. The end of the reaction is indicated by the discharge of the red color of the dye. Following are the details of the process:

Forty grams of sodium metabisulfite, $\text{Na}_2\text{S}_2\text{O}_5$, is dissolved in about 200 ml. of water. This is added slowly to a cooled solution containing about 82 ml. of concentrated sulfuric acid in 650 ml. of water, and the volume made up to 1 liter. This solution contains sulfurous and sulfuric acids.

The dye solution consists of methyl orange, 1 g./l.

The reaction is carried out as follows: Five ml. of the acid electroless bath and 5 ml. of the dye solution are mixed in one flask and 15 ml. of the acid solution placed in another flask. Both are allowed to come to a temperature of $25 \pm 1^\circ\text{C}$. in a thermostat. The sulfurous acid solution is added to the other solution, quickly mixed, and at the same time the stop watch is started.

When the red color fades, the watch is stopped. The concentration of hypophosphite is read from a concentration-time curve. Since the reaction time is affected to some extent by the other compounds present in the bath, a curve should be made for the particular bath used. The reaction time is particularly sensitive to temperature; for example, a certain sample gave the reaction times of 43, 21, and 14 seconds for 20°C ., 25°C ., and 30°C ., respectively.

The following colorimetric method, which was communicated to the author through the courtesy of the Materials laboratory of the General Electric Co.,³⁸ is based on the blue color developed by the reduction of molybdate in sulfurous acid solution. A 25-ml. sample of the acid electroless plating bath is diluted to 1 liter. A 5-ml. aliquot is reacted with 10 ml. of a 10% solution of ammonium molybdate and 10 ml. of fresh 6% sulfurous acid. The flask is covered with a watch-glass and heated to boiling. A deep blue color develops. The contents of the flask are cooled and diluted to 100 ml. The transmittancy of the blue solution is determined at 440 m μ . The blank should consist of distilled water containing the same reagents that were used for the sample. The calibration curve for hypophosphite is linear when plotted on semi-log paper.

A method of determining hypophosphite in the presence of phosphite by oxidizing with a ceric salt has been announced, but the details have not been published.⁴²

Summary

The survey of the literature and of the commercial utilization of electroless plating does not reveal any startling developments, but indicates a gradual growth of knowledge and improvement of the process. Patents covering special uses of the process have been issued; engineering has been applied to large-scale use; the process has been extended to the coating of nonconductors; and solution compositions have been developed which have improved stability and a higher plating rate. While the process is not competitive with electroplating for most purposes, it is the opinion of the author that it has enough special applications so that it will eventually be installed in most plating shops and operated in a routine fashion. The process has many problems which need to be solved and much more research should be done on it. It is indeed surprising that, while so much interest has been shown in electroless plating, so little scientific research has been published on it.



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Testing Rhodium Plate

Question: Do you know of any tests that we could use to 1) verify the presence of rhodium plating, and 2) determine the thickness of rhodium plating over stainless steel?

R. A. B.

Answer: On page 494 of the 1954 edition of the *Metal Finishing Guidebook* you will find a short section on identification of deposits. Platinum group metals are not broken down in this procedure and chemical or spectroscopic methods would be required to identify rhodium in this group.

If the stainless steel base is magnetic, one of the non-destructive magnetic type testers can be used for thickness determination if the rhodium deposit is sufficiently thick and no underlying deposit is present. Otherwise, it is suggested that the base metals be dissolved out and the rhodium flakes weighed.

Carbonate Precipitation

Question: Please send us information on the calcium nitrate method of excess carbonate removal from silver solutions (potassium). We have found brief mention of this method in the *Metal Finishing Guidebook*, but cannot find any particulars as to how much calcium nitrate to use per gallon of solution, and how long to let it stand before filtering back into the plating tank.

R. H. W.

Answer: The reaction of calcium nitrate with carbonates in the solution is as follows: $\text{Ca}(\text{NO}_3)_2 + \text{Na}_2\text{CO}_3 = 2\text{NaNO}_3 + \text{CaCO}_3$. According to this reaction 1 oz. of sodium carbonate and 1 oz. of potassium carbonate will re-

quire 1.6 oz. and 1.2 oz. respectively for precipitation.

It is suggested that, after adding and stirring well, the precipitate be allowed to settle overnight. The clear, supernatant solution can then be readily filtered back into the plating tank.

Black on Brass

Question: We have been requested to apply a black oxide finish on a brass part in accordance with Spec. MIL-P-12011 (ORD) finish No. 22.03 Class A, basically a cuprammonium carbonate solution. We do employ the chlorite-sodium hydroxide method which covers the Class C finish.

The brass parts to be processed will have assembled thereto, an aluminum pin, consequently we hesitate to introduce this assembly into the chlorite-sodium hydroxide method because of its high alkaline nature. We are unfamiliar with the formulative concentration or operation of the cuprammonium carbonate method and will be very grateful to you for your assistance.

V. F. S.

Answer: The cuprammonium carbonate blackening method employs the following formula:

Copper carbonate — 1 lb.
Ammonia — 1 quart
Water — to make 1 gallon

The solution is used at about 175 deg. F. and ventilation is required because of the ammonia fumes.

Passive Nickel

Question: We are having considerable trouble with rainbowing in our chrome when the parts go from bright nickel direct to the chrome. If the nickel is buffed in between, there is no trouble.

We have tried all types of current densities, and all types of rinses after nickel. We have worked our way out of this trouble a number of times, but are unable to tell afterwards just what effected the cure. We carry our ratio at 90-1, as this ratio brings better results for us than a higher one.

E. F. S.

Answer: The condition is due to passive nickel if nickel buffing eliminates the staining, and we would suggest that you cut down on your brightener and anti-pit additions.

For minimizing the staining, general procedure is to clean the nickel plate cathodically in the regular alkaline cleaner, rinse, dip in 20% sulfuric acid, rinse and chromium plate.

Activating materials are available which are added to the sulfuric acid dip and eliminate the cathodic cleaning.

Pitted Silver Plate

Question: We are experiencing difficulty in the heavy silver plating of engine bearings. The bearings are plated with 0.080 to 0.100 inches of silver and fine pin holing of the plate is being encountered in approximately 60% of all bearings plated. (Refer to the enclosed silver sample cut from a bearing.)

The plating cycle consists of a nickel strike, two silver strikes, and finally silver plating in a conventional potassium cyanide bath. Periodic reverse current is used during the plating cycle. The solution is contained in a type 304 stainless steel tank and solution analyses reveal trace amounts of iron, nickel, chromium and copper. Brighteners are not being used in the silver bath.

Information as to what might be causing the pinholing will be greatly appreciated.

J. L. W.

Answer: The pitted appearance of the silver deposit would indicate some type of contamination, or air saturation of the solution; the latter being

caused by air leaking at the packing gland when continuous pumping is employed.

Our suggestion would be to treat with activated carbon in the amount of 5 lbs. per 100 gallons of solution to remove possible organics. Incidentally, brightener is ordinarily advisable in this type of solution.

Silver Plating Flatware

Question: I have been quadruple silver plating by giving parts a good cyanide silver plate then brushing the mud off with a .0025" nickel-silver brush, repeating this operation four times, finally leaving it a satin finish or coloring on a cotton flannel buff with lampblack and kerosene. I am particularly concerned with producing a good wearing and lasting plate on flatware (knives, forks, spoons). Would you suggest a change to a potassium bath to accomplish this? What type of bath do the leading manufacturers use? I do not copper or nickel strike flatware. Still do not get as good a job as I would like for long wearing.

H. J. K.

Answer: For long wearing silver, it would be advisable to use a brightener in the silver solution, since bright silver is very much harder than dull or matte silver. If bright silver is employed, there will be no necessity for scratch brushing four times during the application of a quadruple silver deposit which is somewhat over 0.001" thick.

The leading manufacturers use potassium solutions but we would suggest that you add brightener to your present bath, rather than change over. However, you can make future additions of cyanide as potassium cyanide so that the bath will eventually contain only the latter salt.

Coloring Copper

Question: A job which we are currently setting up for is a large, flat steel door, approximately 2½ feet square which is to be copper plated (.001"), oxidized, high-lighted, and lacquered. We would like information regarding the best method of "activating" the copper plate so as to get a uniform oxidized coating. Some people tell us the best method is a mechanical one, either lightly blasting the copper plate or wet scratch brushing before the oxidizing treatment. We would prefer to eliminate such a mechanical method, as it means extra handling.

What method would you suggest in getting a uniform oxidized finish on the above mentioned large piece? We are assuming that one can plate a uniform copper plate.

Then too, is it general practice to high-light while the film is wet, or is it better to do this with a dry oxidized film? How are the high-lighted parts cleaned before lacquering?

In your 1951 *Metal Finishing Guide-book*, page 450, an article by Hiorns entitled, "Metal Coloring and Bronzing" is cited. Where might we locate this article?

K. H.

Answer: Since the oxidized copper finish is to be highlighted, there should be no necessity for scratch

brushing the surface before oxidizing. The increased uniformity attainable with this operation would be desirable only on large areas which have no design or recesses. Use of an acid sulfate copper solution will result in a smoother copper surface which will take a uniform oxidize.

Highlighted surfaces are generally produced on the dried article with the use of greaseless compound for satin and a hard wheel such as felt with buffing compound for bright finish. If very little buffing compound is used, adhesion is not affected. Otherwise degreasing or wiping with thinner is necessary before lacquering.

Hiorn's book on metal coloring has been out of print for a number of years.

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Degreasing Machine

U. S. Patent 2,673,835. March 30, 1954. T. J. Kearney, assignor to Detrex Corp.

A machine for degreasing work objects comprising an enclosure having side walls at least one of which has an opening of sufficient size to accommodate said work objects, a door movably mounted on said enclosure to open and close said opening, a reservoir for degreasing liquid at a definite level in said enclosure, means for providing degreasing chemical vapors above the liquid in said reservoir, a transverse shaft extending transversely of said side walls, a frame mounted on said transverse shaft with capacity for movement in a rotary path within said enclosure, a plurality of work-object carriers on said frame all substantially equidistant from said transverse shaft, said door and said carriers all being at substantially the same distance from said transverse shaft, said opening being adjacent the top of said rotary path, said liquid level being at a lesser distance from said transverse shaft, and the bottom of said reservoir being at a greater distance from said transverse shaft, power means for rotating said frame on said shaft, thereby swinging each carrier through the vapor, then liquid and again the vapor, and power interrupting means for intermittently stopping each said carrier in the vapor, in the liquid, again in the vapor, and then adjacent said door.

Electrolytic Production of Fluoborates

U. S. Patent 2,672,837. March 30, 1954. C. S. Lowe and H. E. Ricks, assignors to The Pennsylvania Salt Mfg. Co.

In a method for electrolytically producing a fluoborate of the group consisting of lead fluoborate and tin fluoborate the improvement comprising providing fluoborate acid as an electrolyte in a cell having a cathode and

an anode at least a portion of the active surface of said anode being formed of the metal the fluoborate salt of which is being produced, passing an electric current through said cell while maintaining the relative current densities of the cathode and anode such that the current density of the cathode is at least 5 times that of the anode and maintaining the temperature of the electrolyte in the immediate vicinity of said cathode below 100°F. and below the temperature of the main body of the electrolyte in said cell.

Molten Bath Cleaning of Strip

U. S. Patents 2,674,250-1, 2,674,550-1. April 6, 1954. R. Dunlevy, H. Frick and J. H. Shoemaker, assignors to Kolene Corp.

In a metal strip cleaning apparatus for cleaning the surfaces of metal strip by passing the same through a liquid bath comprising a molten alkali metal salt, the combination of an atmospherically open tank containing a bath of said molten alkali metal salt, a pair of tangential rollers mounted above the surface of said bath in a manner to support metal strip passing through said molten salt bath and squeeze excess molten salt from the surfaces thereof, a metal shield overlying the entire length of said tank and said tangential rollers whereby to trap hot gases between said shield and the surface of said bath and reflect sufficient heat upon said rollers to maintain the salt on the surfaces thereof in its molten state while exposing the salt thereon to said hot gases, burners mounted submerged beneath the surface of the bath for heating the bath to maintain the same in a highly fluid state whereby the gases trapped beneath said shield above said bath would normally tend to be highly contaminated with carbon dioxide from the waste combustion gases reactive to form solid abrasive carbonates in the salt film about said rollers, and vent pipes surrounding said burners mount-

ed to receive and vent all of the waste combustion gases away from said cleaning apparatus.

Phosphate Coating

U. S. Patent 2,674,552. April 6, 1954. W. A. Callahan and F. L. Gendernalik, assignors to Detrex Corp.

A metal coating composition consisting essentially by weight of about 85-97.5% dihydrogen phosphate coating chemicals, about .5-5% licorice extract, and about 2-10% boric acid.

Hot Dip Galvanizing

U. S. Patent 2,676,792. April 27, 1954. W. S. Pearson, assignor to Clifton Conduit Co., Inc.

The method of shutting down a zinc pot which comprises separating minor portions of a molten zinc body in the pot adjacent opposite walls of the pot from a major core portion of the molten zinc body, and cooling the molten zinc while maintaining the separation of the minor from the major portions of the zinc body.

Electropolishing

U. S. Patent 2,674,571. April 6, 1954. E. M. Prosen, assignor to Nobilium Processing, Inc.

The method of electropolishing a dental appliance comprising an alloy having the following composition: between about 60 and about 65%, by weight, of cobalt, between about 27% and about 32%, by weight, of chromium, and between about 2% and about 6%, by weight, of molybdenum, which comprises immersing, as anode, said dental appliance in an electrolyte bath consisting essentially of between about 5% and about 22% of H₂SO₄, between about 0.25% and about 5% of HCl, between about 70% and about 84% of ethylene glycol and less than about 8% water; and producing an electric current flow between said dental appliance and an associated cathode.

Pickling Metal Strip

*U. S. Patent 2,676,599, April 27, 1954.
E. C. McHenry, assignor to Allegheny
Ludlum Steel Corp.*

In a system for holding metallic strip material in an acid solution as the strip passes therethrough, the combination comprising, a holddown roll having a metallic housing, a shaft having projecting ends for supporting the housing, a layer of elastomer disposed in adhering relation over the metallic housing and covering at least a portion of the projecting ends of the shaft adjacent the housing, the elastomer on the housing being disposed to contact the strip material and being subject to being punctured thereby during use, the shaft having an opening through each end thereof into the housing, a source of water under pressure, one of the openings being connected to the source of water, the other of the openings being disposed to drain the water from the housing, and means connected to said other of the openings to control the level of the water in the housing to maintain the housing filled with water under pressure, the water within the housing limiting damage to the housing, when the elastomer layer is punctured and admits acid, to the area of the housing closely adjacent to the area of the puncture.

Plating on Aluminum

*U. S. Patent 2,676,916, April 27, 1954.
W. G. Zelle, assignor to Aluminum
Co. of America.*

In a process for electroplating an aluminum article wherein the article is provided with a zinc deposit by immersion in an aqueous alkaline zincate bath and thereafter electroplated over said deposit, the improvement therein which comprises employing in said zincate bath at least one of the hydrous oxides of metals from the iron group, the amount of iron group metal provided being about 0.1 to 1.5 grams per liter of bath.

Tin Coating Containers

*U. S. Patent 2,676,895, April 27, 1954.
R. F. Russell, assignor to American-La
France-Foamite Corp.*

The method of applying a protective coating of tin to the interior of a metal container comprising the steps of rotatably supporting a container in an inverted position and then bodily

moving the inverted container in step by step movement to a plurality of work positions, preheating the container at the first of said work positions, then applying a flux to the interior of the container at a subsequent work position and then spraying molten tin on the interior of the container while rotating the container at a work position immediately following the application of the flux thereto, the steps of applying of the flux and spraying of the tin being carried out with the container being maintained at an elevated temperature.

Porcelain Enameling

*U. S. Patent 2,676,899, April 27, 1954.
S. D. Hackley, assignor to Kaiser
Metal Products, Inc.*

The method of producing a sheet of foraminous metal covered with a continuous coating of vitreous enamel which comprises immersing the foraminous metal sheet in a vitreous enamel slip of fusible glass constituents and approximately 20% by weight, of water, withdrawing the sheet with a coating of the slip material thereon, the forams of the sheet being of such size that a continuous coating of the slip extends across each of the forams of the withdrawn sheet and the thickness of the coating of the slip material in the forams is such that, after fusing, it is of less thickness than the over-all thickness of the sheet, substantially immediately after the sheet has been withdrawn from the slip, and before the slip coating has become dry, subjecting the coated sheet to a sufficiently high temperature for a sufficient length of time to fuse the coating, and cooling the coated sheet while the coating still extends across the forams thereof so that the film of material in all of the forams remains continuous.

Nickel-Zinc Composite Plate

*U. S. Patent 2,676,917, April 27, 1954.
M. B. Hammond and G. B. Bowman,
assignors to Rockwell Spring and
Axle Co.*

The method of making a corrosion resistant article having a bright surface, which comprises electrodepositing on a metal base a layer of nickel having a thickness of at least .00005", electrodepositing on the nickel layer a layer of zinc having a thickness of at least .000005", buffing the deposit for a time sufficient to cause all the zinc

to penetrate into and alloy with the nickel and produce a bright surface, and electrodepositing a layer of chromium on the bright surface.

Spray Buffing Compound Applicator

*U. S. Patent 2,677,219, May 4, 1954.
W. C. Burt, assignor to Clair Mfg.
Co., Inc.*

A spray gun mover mechanism comprising a stationary frame, guide rail means mounted on said stationary frame, a first gear rack mounted upon said guide rail means for longitudinal shifting movements thereon, bracket means extending from said first gear rack for mounting the spray gun thereon to reciprocate with said gear rack relative to said stationary frame, a second gear rack fixed to said stationary frame to extend in spaced parallel relation to said first gear rack, a gear disposed between said first and second gear racks to extend in meshing relation therebetween, and a powered push-pull member connected at one of its ends pivotably to the center of said gear and extending therefrom into connection with a push-pull power source, whereby displacements of said push-pull member will force said gear to be displaced relative to said fixed frame and to rotate due to its meshed connection with said second rack to thereupon drive said first gear rack to move at twice the rate of movement of said push-pull member.

Bright Copper

*U. S. Patent 2,677,654, May 4, 1954.
A. E. Chester and J. T. Irwin, assignors to Poor & Co.*

An alkaline copper cyanide plating bath comprising copper in a soluble form dissolved in an alkaline cyanide aqueous liquid containing dithiobiuret dissolved in said bath, the quantity of dithiobiuret being sufficient to produce a bright plate when copper is electrodeposited from said bath.

Rust Preventive Compositions

*U. S. Patent 2,677,618, May 4, 1954.
E. A. Dieman and A. W. Lindert, assignors to Standard Oil Co.*

A composition consisting essentially of from about 5% to about 40% of a preferentially oil-soluble sulfonic acid soap selected from the group consisting of a preferentially oil-soluble alkali metal sulfonate, a preferentially oil-

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soluble alkaline earth sulfonate and mixtures thereof, from about 1% to about 10% of a morpholine soap of an aliphatic mono-basic acid of at least about 12 carbon atoms, and from about 5% to about 80% of a normally liquid hydrocarbon.

Bright Copper

U. S. Patent 2,677,653. May 4, 1954.
A. E. Chester and J. T. Irwin, assignors to Poor & Co.

An alkaline cyanide plating bath comprising copper in a soluble form dissolved in an alkaline cyanide aqueous liquid containing an addition agent made by subjecting a by-product aqueous alkaline cyanide solution de-

rived by absorbing coke oven gases in alkaline aqueous solutions and containing organic contaminants and sulfur, some of which is organically combined, to treatment with cuprous oxide and an alkaline polysulfide followed by filtration, the quantity of said addition agent being sufficient to enhance the brightness of copper electrodeposited from said bath.

Spray Blast Cleaning Cabinet

U. S. Patent 2,677,381. May 4, 1954.
J. L. Fisher, assignor to Spray-Blast Corp. of America.

A cleaning device comprising a cabinet having an open front, and upper and lower spray and drip chambers

respectively, a blower for withdrawing vapor from the upper end of said spray chamber, a cleansing fluid tank in said drip chamber. drain means between said chambers discharging liquid from said spray chamber into said tank, means for withdrawing cleaning fluid from said tank and spraying the same into said spray chamber, said tank having a cover comprising a fixed section covering a portion of the top of said tank and a sliding section, resilient means urging said sliding section to closed position, a fusible member connecting said sections and retaining said sliding section in open position.

Core for Filter Elements

U. S. Patent 2,677,466. May 4, 1954.
R. P. Lowe, assignor to Proportioneers, Inc.

In a liquid filter, a support and under drain comprising a functionally rigid tubular core, a narrow strip of material supported by said core and tightly wound helically about the core, and a powdered filtering medium coated on said helically wound material, said helically wound material being spaced to provide a filtrate passage and yet being sufficiently close to support said powdered medium, said core being of expanded metal with the openings therethrough so arranged with reference to the helical filtrate passage as to be staggered and overlap along the helical passage whereby inward drainage may occur of such extent as to provide no substantial additional pressure loss across the filtering medium and the helically wound material.

Continuous Strip Tinning

U. S. Patent 2,677,652. May 4, 1954.
R. E. Howell, assignor to United States Steel Corp.

The method of continuously electro-tinning steel strip in acid tin plating baths to prevent wood grain and like defects comprising passing said strip in a plurality of plating passes through an acid tin plating bath having a preferred operating range of current density, each of said passes including a negative contact roll for establishing the strip as cathode, a sink roll disposed in the bath and anodes disposed on either side of the strip in the bath between said contact roll and said sink roll, applying sufficient current to said

strip during the passage through the total of said passes to deposit a desired weight of coating thereon, the current density in at least the first of said passes being maintained substantially below the preferred operating range of the bath when used for continuously plating moving strip and at least below 20 amperes per square foot, the current density in at least the last of said passes being maintained at a value within said preferred operating range of said bath.

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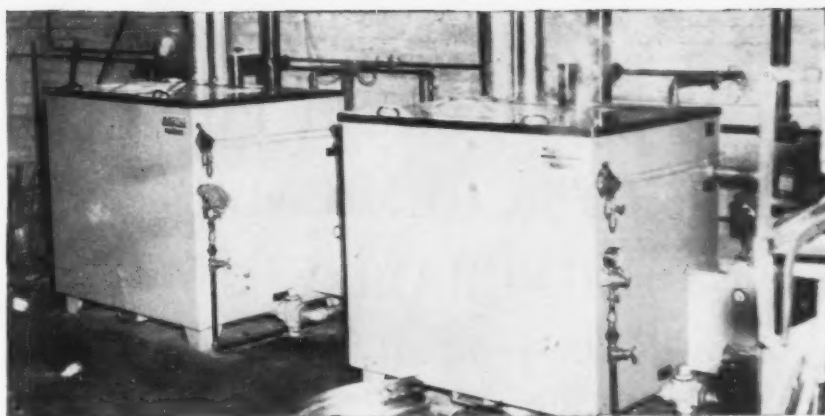
*U. S. Patent 2,677,922. May 11, 1954.
G. E. McGuire, assignor to J. M. Nash Company.*

A working head for a device of the character described to guide the path of travel of an abrasive belt, said head having a central forwardly facing shoe covered with a resilient pad contoured approximately to said path of travel but sufficiently resilient for distortion under pressure of the abrasive belt, and a contour roll adjustably mounted to said head for adjustable positioning to a fixed location at one side of the shoe in contact with said belt whereby to accurately define said contour, said shoe having a working face provided with an anti-friction web and web supply for feed of said web across the face of the shoe under the belt, and a clamp between the web supply and the shoe to determine feed of increments of said web across said face.

Fused Bath Pickling

*U. S. Patent 2,678,290. May 11, 1954.
J. H. Noble, R. Pottberg and Uryln C. Tainton, assignors to Freeport Sulphur Co.*

A process for the treatment of surface oxide films on a metal article for the purpose of removing surface oxides therefrom comprising providing a molten bath of the group consisting of the alkali metal hydroxides and alkali metal chlorides, immersing said article in said bath without connection of said article or bath as an electrode of an electric source, introducing oxygen in gaseous form from an outside source into said molten bath, subjecting the said surface oxides of said immersed article to the oxidizing action of said molten bath into which said oxygen in gaseous form has been introduced and continuing said oxidizing treatment to the modification of said oxides to a form easily removable in acids.



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Method for Detecting Cyanide

*U. S. Patent 2,678,260. May 11, 1954.
M. M. Falkof, B. Witten and B. Gehauf, assignors to the United States of America.*

A method of detecting a cyanide of a group consisting of the alkali cyanides and hydrogen cyanide in a suspected solution wherein, if said cyanide be present, the solution first appears to be pink, then blue; said method consisting of buffering the solution with sodium carbonate, chlorinating the cyanide with a water soluble chloramine, and adding a liquid reagent consisting essentially of a sulphur-free organic compound containing a pyridine ring and 1-phenyl-3-methyl-5-pyrazolone.

Fused Bath Pickling

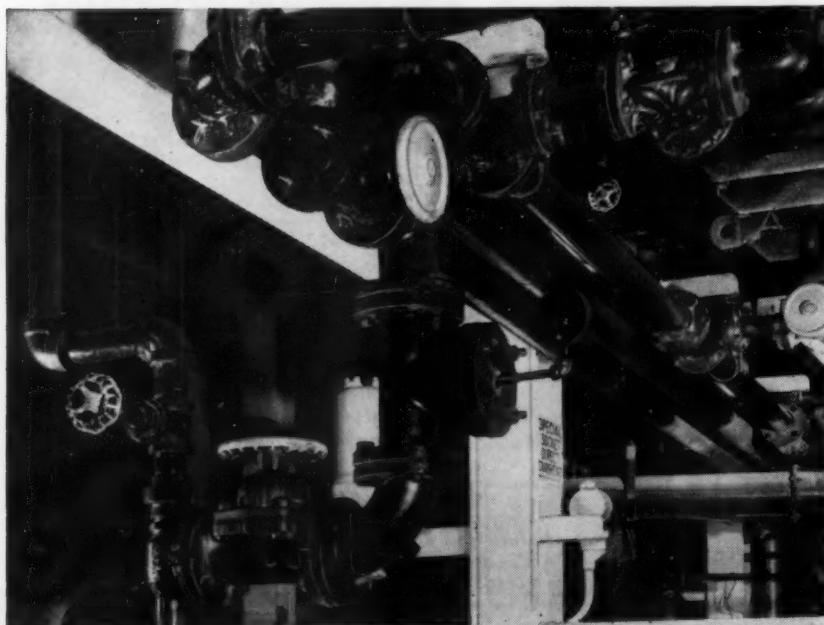
*U. S. Patent 2,678,289. May 11, 1954.
J. H. Noble, and R. Pottberg and Uryln C. Tainton, assignors to Freeport Sulphur Co.*

A process for the treatment of surface oxide films on a metal article for the purpose of removing surface oxides therefrom comprising subjecting the surface oxides free of electric circuit connection to the action of a fused inorganic salt of the group consisting of the alkali and alkaline earth metal hydroxides and carbonates and containing oxygen in gaseous form, and continuing said treatment to the modification of the oxides to a form easily removable in acids without depletion of the treated metal, and then treating



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said surface in an acid bath to remove remaining modified oxides.

Conversion Coating Aluminum

U. S. Patent 2,678,291. May 11, 1954.
F. P. Spruance, Jr. and N. J. Newhard,
Jr., assignors to American Chemical
Paint Co.

In a process for coating aluminum, the step which consists in treating the surface with an acid aqueous solution the essential active coating producing ingredients of which are fluoride ions, dichromate ions, ions from the class of arsenate and phosphate ions, and ions from the class of chloride and sulphate ions, the ions being present in amounts stoichiometrically equivalent to

Grams per liter

Fluorine 0.15 to 12.5

Chromic acid (CrO_3) 7.4 to 66.6

Ions of acids from the class consisting of phosphoric and arsenic acids (calculated as PO_4) 2 to 285

Ions from the class consisting of chlorides and sulphates (calculated as NaCl) 1 to 50

the ratio of fluoride ion to dichromate, expressed as $\text{F}:\text{CrO}_3$, being from 0.015 to 0.13; the pH of the solution being from about 1.0 to 3.2, as measured by a glass-electrode pH meter after a nearly steady reading is obtained.

Liquid Abrasive Blasting

U. S. Patent 2,678,520. May 18, 1954.
M. H. Jewett, assignor to American
Metaseal Mfg. Corp.

In wet blast abrasive cleaning apparatus the combination of a base, a cleaning cabinet having enclosed top and side walls and an open bottom wall, grate means at the bottom of said cabinet arranged to support an object to be cleaned, means supporting said cleaning cabinet in spaced relation to said base, a hopper movable on said base and adapted to be positioned below said grate means in communication with the interior of said cabinet, said hopper being adapted to retain a liquid solution containing abrasive particles, means including a source of compressed air and a nozzle communicating with the interior of said hopper and adapted to draw said solution therefrom for forcible impingement on an article to be cleaned.

Mat Finish for Copper Alloys

U. S. Patent 2,678,876. May 18, 1954.
D. G. Burnside, assignor to Radio Corp. of America.

In a method of imparting a mat finish to a polished surface of a metal of the class consisting of copper and brass, the steps of treating said surface with a solution consisting essentially of water, about 10-40% by weight of ammonium persulfate, and about 0.3 to about 1.5% by volume of hydrogen peroxide, and continuing said treatment until said mat finish has been formed.

Bright Dipping Aluminum

U. S. Patent 2,678,875. May 18, 1954.
R. C. Spooner, assignor to Aluminium Laboratories, Ltd.

The method of brightening aluminum which comprises subjecting the same to a hot, concentrated phosphoric and nitric acid brightening bath which contains a major proportion of phosphoric acid and a minor proportion of nitric acid, and inhibiting the metal-dissolving chemical action of the bath on the aluminum relative to the attainment of a desired brightness of the aluminum under said chemical action, by incorporating silicic acid in said bath.

Nickel Plating Bath

U. S. Patent 2,678,910. May 18, 1954.
H. Brown, assignor to The Udylite Corp.

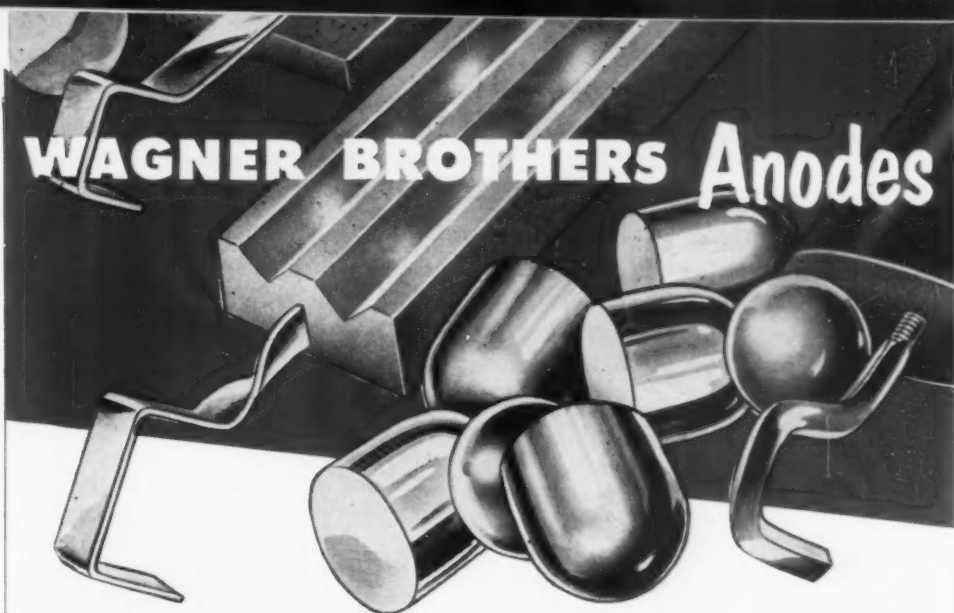
A bath for the electrodeposition of nickel comprising an aqueous acidic solution of at least one nickel salt selected from the group consisting of nickel chloride, nickel sulfate, nickel fluoborate and nickel sulfamate, said bath also containing, in solution, not more than about .5% of at least one bath-soluble fully esterified aliphatic ester of an unsaturated aliphatic polycarboxylic acid, said ester being unsaturated and the unsaturation of which is due solely to double bonds in the said acid.

Abrasive Wheel

U. S. Patent 2,680,335. June 8, 1954.
E. Hurst, assignor to United Cotton Products Co.

An abrasive article comprising a compressed body of toroidal windings of abrasive-containing fibrous strip material.

WAGNER BROTHERS Anodes



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TIN

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ABSTRACTS

Film Thickness Determination of Metal Coatings on Aluminum by Chemical Solution

W. Wiederholt and B. Kaspras: *Metall.* Vol. 6, pp. 509-511.

A process described for the determination of the coating thickness of Cr, Ni, Cu and similar metals on aluminum and aluminum alloys by solution of the coatings using fuming nitric acid with small additions of hydrochloric acid or chlorate, without the base metal suffering any marked attack as with fuming nitric acid.

Surface Treatment of Zinc and Zinc Alloys

K. Bayer: *Metall.* Vol. 6, pp. 511-513.

A survey is given of the technical position and of new developments in this field. Details are given of electroplating processes — coppering, nickel and chrome plating, non-metallic processes, chromating, phosphating and lacquering.

The D Chrome Plating Process (Tetrachromate Bath)

By A. Kutzelnigg: *MetallOberflaeche.* Vol. 5, No. 10, pp. B156-B160.

This new D chrome plating bath is not intended to replace either the decorative chrome bath or the hard chrome bath but, because of its special characteristics, its true function is as supplementary to these two baths and so increasing the range and sphere of application and usefulness of chromium plating. This new bath renders possible a satisfactory chrome plating in those cases where the standard baths cannot be applied with any degree of safe assurance. The D chrome bath differs from the bright baths in that the chrome deposit from the D bath requires to be polished and it differs again from the hard chrome bath in what the chrome deposit from the D bath is softer than hard chrome. The composition of the D chrome bath can be broadly designated as a tetrachromate bath. This bath has actually been known for some time and has been applied to a certain extent. In

Germany over the last two years this bath has been improved both in composition and in method of operation and is now coming into commercial use.

The characteristics of the D chrome bath may be broadly summarized as follows: The working temperature of 20°C. should not be exceeded to any appreciable extent. Current densities of 50 amp./sq. dm. and more are used with current interruption. The current efficiency is about 37%; because of this and as a consequence of the high current densities which can be applied, comparatively rapid deposition is possible. The bath has a better throwing power than the standard bright chrome bath. The properties of the chrome deposit from this bath are: Grey matt chromium coatings which can however be easily polished; there is a lower porosity of the chrome coating in comparison with bright chrome coatings and a possibility of metal forming and shaping after chrome plating.

The principal fields of application for which this bath is suitable are as follows: (1) Direct chrome plating of cast brass and pressed brass ware. With a plating current of 50 amp./sq. dm. for 4-6 minutes there is obtained a 4 to 5 microns thick coating of chromium which provides a good corrosion protection. It is well known that the direct bright standard chroming of brass leads to defects. The chrome coating rapidly peels away and ultimately gives rise to accelerated corrosion because of local cell formation. (2) The chroming of iron and zinc over a copper undercoat. With normal chrome baths, chroming directly over a copper undercoat cannot be regarded as providing satisfactory corrosion protection unless the chromium is subsequently coated with a colorless lacquer. Depositing a 4-6 micron thick coating directly from the D bath has however proved satisfactory. Accordingly it can be accepted that with this bath it is possible to chrome on iron or zinc without a nickel undercoat. (3) The D chrome bath possesses a considerably better throwing power than the standard bright chrome bath and can be applied with advantage in such difficult cases in which a good throwing power of the bath is a necessity. (4) Some specialized technical plating problems which ordinarily present difficulty can be satisfactorily solved with the D chrome bath. These are: the chrome plating of soft

soldered parts; progressive chrome plating of lengthy profiles; chrome plating of brass components which must remain non-magnetic without a nickel undercoat; press forming of chromed parts after a 6 micron coating and the chrome plating of graphite. The Ferroxyl test showed that with a 4 micron chrome coating only a few pores could be seen and with an 8 micron coat, no pores.

New Development Tendencies with Chrome Plating

H. W. Dettner: *MetallOberflaeche.* Vol. 5, No. 10, pp. B149-B151.

The endeavor to plate chromium from solutions of its salts as in other plating processes has directed attention to the possibilities of the fluoride containing plating baths. For this purpose, hydrofluoric acid, boric acid and mixtures of these two acids come into consideration particularly in conjunction with sulfuric acid. Work has been done in Germany on the fluoride containing baths. Although, on the one hand, these fluoride-containing catalyzers attack the anodes, bath containers, non-chromed parts of the ware and the hanging racks more rapidly than is the case when sulfuric acid is used, the fluoride bath analysis is more difficult and there are other disadvantages, on the other hand the fluoride baths have some appreciable advantages which are of outstanding importance for a wide field of application. In this connection there can be cited the higher current efficiency, the better throwing power of the bath and the wide bright plating range which can be expected as well as the possibility of interrupting the current and then continuing the plating without the deposit assuming a matt appearance. This last property is of great significance in respect to drum and barrel plating and almost all the electrolytes for this purpose are fluoride-containing. The content of fluoride-containing free acid varies and examples of bath compositions are: (1) 380 g./l. CrO_3 and 1.3 g./l. HF; (2) 350 g./l. CrO_3 and 1.7 g./l. H_2SiF_6 ; (3) 100-400 g. CrO_3 , 0.5-2 g. H_2SO_4 1-7 g. BF_3 with 1 liter H_2O ; a similar bath works at 27 to 32°C. and contains chromic acid, boric acid and ammonium fluoroborate.

An interesting tendency in Japan has been the large scale development of cold working chrome plating baths

on a fluoride basis. Electrolyte compositions currently in use are: (1) 250 g./l. CrO_3 , 3 g./l. $\text{Cr}_2(\text{SO}_4)_3$ and 1.5 g./l. NH_4F ; temperature is 25°C ., voltage 4.5, current density 5.4-7.5 amp./sq. dm. Similar bath compositions are also in use which are modified slightly to suit requirements and working conditions and examples are (2) 250-300 g./l. CrO_3 and 0.75 to 1.5 g./l. NH_4F and (3) 360 g./l. CrO_3 , 1.5 g./l. NH_4F and 0.4 g./l. $\text{Cr}_2(\text{SO}_4)_3$. Bath No. 2 produces a darker, bright plate which is useful for some purposes while No. 3 produces a more bluish tone suitable for general application. Baths with the higher chrome salt content do not tend so much to burn and give a brighter deposit. As mentioned, these baths have been evolved particularly for barrel and drum plating to overcome the difficulties otherwise encountered; nickel is generally applied before the chrome but, in some cases, the chromium can be applied directly. In such cases it is general to chrome for 10 minutes and an average coating thickness of 0.1 to 0.3 microns is then obtained. The maximum plating speed lies at about 2.5 microns per hour. Practically any desired coating thickness can be obtained with barrel and drum plating. Small component parts in a barrel unit about 40 cm. require 200 to 300 amps at 5-7 volts. The bath temperature is 35°C . The color tone of parts which are chromed in mass plating baths differs only very slightly from those which are plated on a rack or in a basket.

Treatment of Aluminum Surfaces

A. Jaget: *Revetement et Protection*. No. 29 (1953), p. 31.

For decorative purposes or to increase the corrosion resistance of aluminum, it is often lacquered and, to obtain adhesion of the coating, a preliminary surface treatment of the metal is necessary. A suitable procedure which has been developed is to degrease in trichlorethylene and vapor phase degreasing is to be preferred. If immersion degreasing in the trichlorethylene is practiced one runs the danger that a grease film can be left on the ware after treatment. If the degreasing is conducted in a solution of trisodium phosphate, then it becomes necessary to add a bath inhibitor. If it is desired to obtain a roughened surface then a sand blasting operation is

used or the surface is scratch brushed. By means of a pickling stage, whether alkaline or acid, the oxide film which acts as a protective coating, is removed from the metal surface. The removal of this coating reduces the corrosion resistance of the metal. It is of practical importance to select those treatments which increase the effectiveness of this protective coating.

This result can be achieved by phosphating with phosphoric acid in the presence of butyl alcohol. According to the M.B.V. process, the aluminum is treated for 10 minutes in a solution of 5% sodium carbonate and 1.5% sodium chromate, the ware is rinsed and treated again at 100°C . in a dilute solution of water glass. With the Alroc process the aluminum is treated for 15 minutes at 85°C . with a solution of 1% sodium carbonate and 0.1% potassium dichromate. After rinsing, the processing is finished by a treatment with a 5% potassium dichromate solution at 85°C . These two processes produce a protective coating on the aluminum surface of a thickness of 2 microns and this provides a very good base surface for subsequent lacquering. The anodic oxidation treatment in sulfuric acid may perhaps be regarded as the best processing treatment of all; it is capable of producing a protective film on the aluminum of 10 to 20 microns and this is both a good protective coating and a good base for subsequent lacquering.

Electroplated Deposits on Aluminum and Aluminum Alloys

Metallwaren Industrie und Galvanotechnik: Vol. 44, Nos. 3/4, pp. 139-142.

All pretreatment processes prior to plating have as their result that the metal surface is more or less roughened. Mechanical surface roughening has not been introduced. Before the pretreatment stage all dirt and grease constituents must be removed. For the degreasing, hot baths of caustic soda or sodium carbonate are of only limited use because the metal is too strongly attacked with these agents. Solutions have been specially developed for this cleaning stage which do not attack the metal. This degreasing is concluded by a short electrolytic degreasing. All the usable electrolytes can be used for this treatment. Electrolytes by which simultaneously a metal deposition takes place are ex-

cluded. The electrolytes should not be too concentrated and should contain materials which inhibit the attack of the alkaline constituents contained in the bath. The ware must be hung in the bath with current on. The treatment time in the bath should not be longer than 30 seconds. An oxide coating is formed on the metal which is removed by immersion in hot caustic soda solution to which sodium chloride has been added. A bath composition for the purpose is: 100 g./l. caustic soda; 20/30 g./l. sodium chloride. The bath temperature is 50° to 70°C . and the immersion time 10 to 20 seconds.

When the gas generation which occurs takes place uniformly over the whole surface, the ware is removed from the bath and rinsed. With copper-containing aluminum alloys, the surface appears a dark gray color. This dark colored coating is removed by a short dip in dilute nitric acid (1 part nitric acid and 1 part water). The parts must then be immediately passed on for further subsequent treatment.

The next working stage is the formation of the bonding coating. The two well known processes employed here are the zinc bath and the iron bath. For the preparation of the zinc bath, 90 g. caustic soda are dissolved in 1 liter of water, then 60 g. zinc sulfate are dissolved in 1 liter of water, and the two solutions are mixed with stirring, so that the precipitate which is first formed again dissolves. The bath temperature is 40°C . and the dipping time 30 seconds. The ware is agitated while in the zinc bath. A light gray deposit of zinc is formed on the aluminum. If the precipitated zinc has a spotty appearance, this must be removed by dipping in nitric acid and the dipping in the zinc bath repeated. For Al-Mg. alloys and for Al-Si. alloys, the zinc bath recommended is 10 g./l. caustic soda, 5 g./l. zinc oxide and 500 g./l. sodium potassium tartrate. For all other alloys the bath contains 45 g./l. caustic soda and 5 g./l. zinc oxide. The dipping time with these last baths is 2 minutes at room temperature. For the iron bath, the composition is as follows: 2.5 liters of saturated iron chloride solution and 2.5 liters of concentrated hydrochloric acid to 100 liters of water. The bath temperature is 90° to 100°C . and the dipping time with movement of the ware is 30 to 40 seconds. Another bath is proposed containing 50 g./l.

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That's Mr. Jim Taylor speaking. He's supervisor of finishing operations, Black & Decker Manufacturing Company, Towson, Maryland

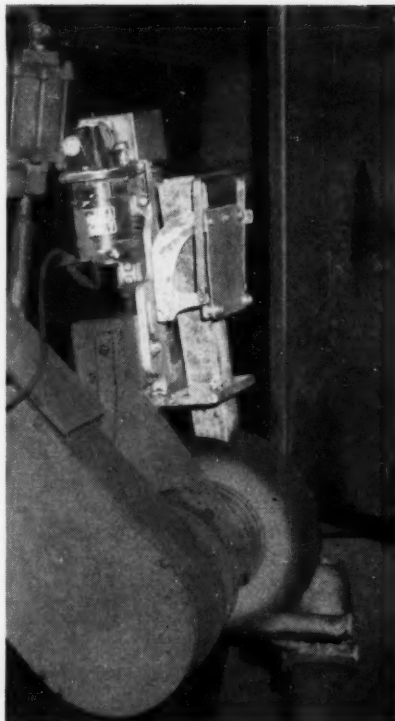
He's referring to a tough problem in automatic buffing recently encountered in his plant. The bugaboo was the many contours and "hard-to-get-around" projections on an aluminum casting for a B & D electric saw. A standard buffing machine had to be altered . . . and Nankervis applicators were given the job of feeding bar compound to specially-constructed buffs

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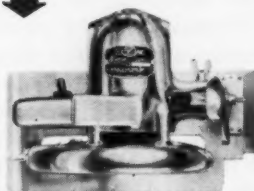
GEORGE L. NANKERVIS COMPANY

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(1) Here's a Nankervis applicator at work

(2) Here's the complex casting



iron chloride and 50 g./l. hydrochloric acid. A part of the hydrochloric acid can be replaced by tartaric acid.

In all the above processes, the endeavor up to this stage is to remove the oxide coating from the metal. Other processes have been developed which have as their object the strengthening of this oxide layer. The Elytal process uses a phosphoric acid bath and employs anodic oxidation. The treatment time here is 10-15 minutes. Finally, by cathodic treatment, a part of the oxide coating is again dissolved off and then copper or nickel applied. With the Krome-Alume process, the anodic oxidation is conducted with alternating or direct current in an oxalic acid electrolyte. The oxidized parts are dipped in dilute hydrofluoric

acid up to 5 minutes. This concludes the preparation stage and the plating treatment follows. The author gives details of nickel plating, bright chrome plating and hard chrome.

Investigations of Pickling Inhibitors

S. A. Balezin and S. K. Novikov: *Zhurnal Prikladnoi Khimii*. Vol. 24, pp. 283-288.

Investigation was conducted on formaldehyde as regards its effect as an inhibitor in sulfuric and hydrochloric acids of varying concentration of 0.2 to 1,000 millimol/liter and 5/N acids at room temperature for 24 hours. With 50 millimol of formaldehyde it was found there was a minimum; further additions were harmful.

Solution of the steel was also influenced by two factors one of which is the inhibitive effect which increases with rising concentration. Formaldehyde is reduced by atomic hydrogen to methyl alcohol which exerts an increased effect on the solution of the steel. This rises with rising formaldehyde concentration. In 5/N H_2SO_4 the hydrogen volume was almost equivalent to the loss in weight of the steel; with the addition of 1 mol of formaldehyde per liter, however, only about 40% of that corresponding to the loss in weight, so that 60% was reduced to methyl alcohol.

Hexamethylenetetramine was recommended in 1920 as an inhibitor by Chamberlain. It is decomposed in acids and forms mainly formaldehyde, ammonia, CO_2 and methylamine. The degree of the decomposition rises with the hydrogen ion concentration and the temperature. For this reason, hexamethylenetetramine was investigated in a concentration range of 0.2 to 100 millimol. With 50 to 100 millimol of hexamethylenetetramine/liter the solution of the steel is 1.5 times as great as in pure acid. With this concentration the stimulating effect thus overshadows the inhibitive effect. Previous work done by Portevin, Pretet and Huittou on the initial kinetic of the steel solution in H_2SO_4 and with the addition of 5 millimol of hexamethylenetetramine over a test period of 2.5 hours, showed that in pure H_2SO_4 the rate of solution dropped with the time but increased in the acid with addition. The test temperatures were between 20 and 80°C. The temperature coefficient (for each 10°C.) is 2.05 for pure acids and 2.5 for acids with addition. The effect of the inhibitors on the temperature coefficients is thus small as opposed to the postulations of W. Machu, according to whom all inhibitors should reduce the temperature coefficients. As opposed to hexamethylenetetramine, the solution rate sinks with time in the same way as with pure acids with an addition of thiodiglycol. The influence on the temperature coefficients is also very small with thiodiglycol, i.e. 2.05 with 2/N and 5 w./v. acids; 1.95 for 2/N acid and addition and 2.05 for 5/N acid and addition. Thiodiglycol works powerfully in 5/N H_2SO_4 . It was found that 30 millimol to 5/N H_2SO_4 reduces the solution in the ratio of 16; on the other hand, this inhibitor works weak-

ly in HCl. Thiodiglycol is decomposed by atomic hydrogen.

Coloring of Metals

Metallwarenindustrie und Galvanotechnik. Vol. 44, No. 5/6, p. 14.

The coloration of metals by immersion in salt bath melts is considered. The color tone obtained by a caustic soda salt bath depends on the bath temperature. Operating results as follows are obtained at the temperatures given:

Pale yellow	220°C.
Straw yellow	240°C.
Brownish yellow	260°C.
Bright purple	280°C.
Dark purple	300°C.
Clear blue	320°C.
Blue with a greenish shade	330°C.

For chromed parts which are required to be colored black, the following bath composition should be used:

Sodium cyanide	45%
Sodium bicarbonate	35%
Sodium chloride	20%

Bath temperature just above the melting point. Immersion time is 2-3 minutes.

An aqueous dipping bath for metal coloring is as follows:

Copper sulfate	50 g.
Ammonium chloride	25 "
Sodium chloride	25 "
Zinc chloride	6.5 "
Acetic acid	12.5 "
Water	1 l.

The cleaned parts are dipped in this solution until the desired color tone has been obtained.

"Old English" and "English Brass" color tones are obtained by alternate dipping in the following Solutions 1 and 2 with intermediate rinsing in cold water:

Solution 1. Liver of sulfur	3.1 g.
Water	1 l.
Solution 2. Copper sulfate	12.5 g.
Water	1 l.

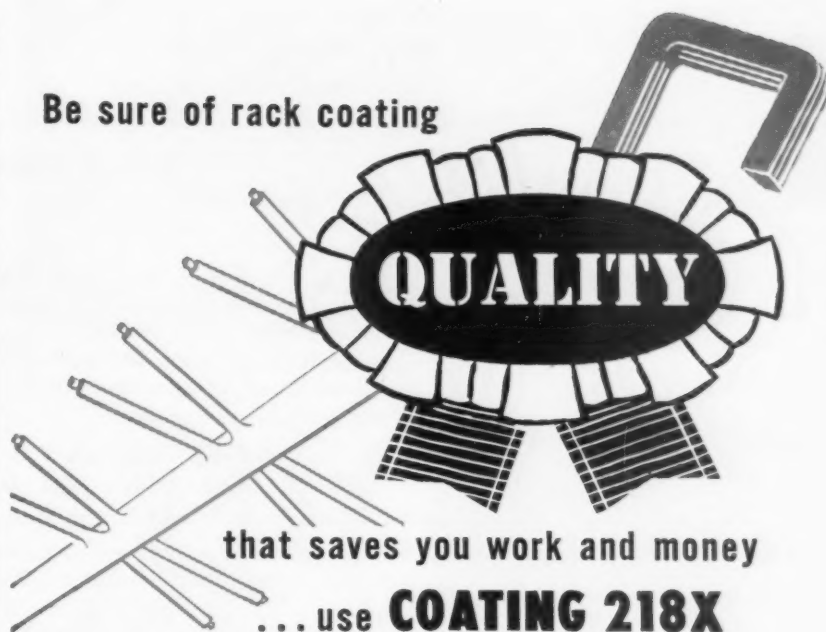
An intermediate brushing is given between the two baths with pumice powder.

Direct Nickeling of Aluminum

Chem. Rundschau (Solothurn). Vol. 5, p. 270.

Experience with the Udytal process

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IN plastisol Unichrome Coating 218X you get genuine quality which quickly shows up on the job. It withstands all plating, anodizing and cleaning cycles—even those with vapor degreasing cycles. This keeps coating costs at bedrock, simplifies racking. Coating 218X won't contaminate even the "fussiest" of plating solutions—thereby avoiding future trouble and costly downtime.

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is described. Because of the location of the potentials a uniform coating can only be produced on aluminum if it is first covered with a coating of iron or zinc. The zinc coating is more widespread in use and, at the plating stage, a copper coating is first applied over the zinc to avoid reaction between the zinc and the nickel sulfate. The newest practice is to replace the copper plate by a special nickel bath. Aluminum surfaces plated with nickel in this way are fault-free with a considerable reduction in the working time. Also some 23 working stages with the normal process can be reduced to 18 stages. The processing time for the zinc coated aluminum amounts to 15 minutes with a bath

temperature of 25°C. and a current density of 1.5 amp./sq. dm. The process is applicable both to rolled and wrought alloys.

Passivity of Stainless Steels in Acid

J. Defranoux: *Revue de Metallurgie*. Vol. 49, pp. 664-672.

The author gives details regarding the initiation of passivity in stainless steels with 18% chromium and 8% nickel in acids, particularly sulfuric acid, as well as the influence of oxidizing additions. Details are also given regarding the stability of the passivity and the effect of a surface activation by sand blasting.

Recent Developments

New Methods, Materials and Equipment
for the Metal Finishing Industries

Bench Rectifier

Rapid Electric Co., Dept. MF, 2881
Middletown Road, Bronx 61, N. Y.



A new, low-cost bench selenium rectifier, with continuously variable output control ranging from zero to full rated power, has been designated Model 1020 F. The full wave design unit operates on an input of 110-120 volts, single phase, 60 cycle AC; with a rated output of 20 amperes 0-10 volts, D.C. An inductive capacitive filter provides an output with less than 5% ripple. Designed for extra heavy duty, continuous (24 hour) operation is possible; and provision is made for 20% overload for 2 hour periods.

Model 1020 F is furnished complete with 2% F. S. accuracy volt and ammeter, pilot light, starting switch, and fuse overload controls; and is fully guaranteed for one year. A low cost unit, the full list price is \$115.00, and immediate delivery can be made from stock. A data sheet is available and will be sent on request.

Bright Cadmium Process

Frederic B. Stevens, Inc., Dept. MF,
Detroit 16, Mich.

An improved process for electroplating of cadmium, the Stevco bright cadmium process, was designed especially to supply the demands of industry for a genuine bright cadmium deposit to meet definite thickness of deposit and corrosion protection specifications for iron and steel plating.

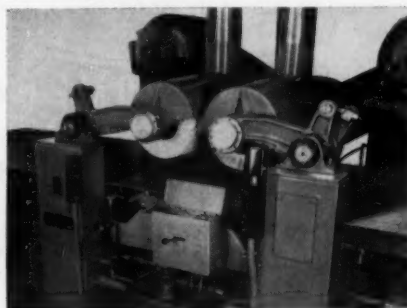
Use of an economical liquid brightener, Stevco Liquid Brightener, it is stated, permits extremely easy control

of the new process and allows complete and immediate integration with the solution. This feature increases economy in operation while providing an easier and faster method of handling additions as required.

Polishing Machines

Central Machine Works, Dept. MF,
72 Commercial St., Worcester, Mass.

The above firm has added a new series of tandem roll horizontal polishing machines to its line of vertical and horizontal machines. The features of these machines are the electro-hydraulic controls, the patented hydraulic contour device for automatically following the contours of shaped pieces, and the tandem roll feature which permits rough cut, or cut-down, and finishing at only one work set-up. The machines are said to be designed to handle extrusions of all types, sheets, plates, rods, tubing and many odd-shaped items.



The polishing rolls are powered by motors of ample capacity. Stroke is from two inches to full capacity of machine in stepless increments. The hydraulic contour device is patented and is standard equipment on all machines. The work- or fixture-table is available in any width or length depending on the size of work to be finished. The table may be oscillated crosswise at the will of the operator. These machines are said to be sturdy, rugged fabrications designed for dependable operation and high production on all extrusion work.

Chromate Conversion Coating

Promat Division, Poor & Co., Dept.
MF, 851 S. Market St., Waukegan, Ill.

A new chromate treatment for hot

dip galvanized surfaces, identified as Proseal D-36, is said to give good resistance to the formation of white corrosion products without discoloring galvanized surfaces.

The following results were reported where the process was applied to hot dip galvanized sheet in continuous mill operations:

A minimum of zinc dilution was evidenced.

There was no discoloration of the surface.

Treated surfaces resist corrosion in pack test.

A red liquid, the product is packed in 12 gallon carboys. In use, its life is sufficiently long to eliminate the desirability of analytical control.

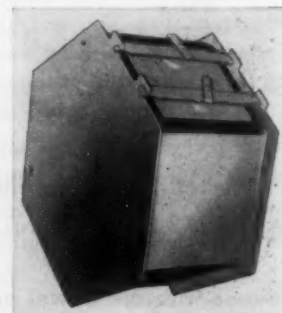
Replacement Barrels

Rampe Mfg. Co., Dept. MF, 3320
St. Clair Ave., Cleveland 14, O.

For the convenience of those manufacturers who wish to rebuild or remodel their existing tumbling and burring machines, or construct a machine of their own design, the above firm is now offering separate tumbling and burring barrels.

At the present time four styles and sizes of this equipment are available—A hexagonal, conical open end tumbling barrel of 7½ gallon volume, 16" high of welded, water-tight construction. Three sizes of closed hexagonal steel burring barrels—5 gallon, 1.1 cu. ft. and 2 cu. ft. (illustrated) volume respectively. Perforated sheet metal doors are available for each of these models for draining liquids.

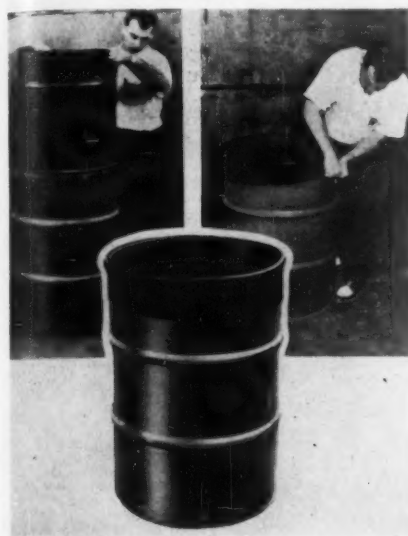
All four of these barrels can be fur-



nished with vinyl plastic coating, if desired. Barrels can be relined at any time.

Rubber Inserts for Drums

Automotive Rubber Co., Inc., Dept. MF, 12550 Beech Road, Detroit 39, Mich.

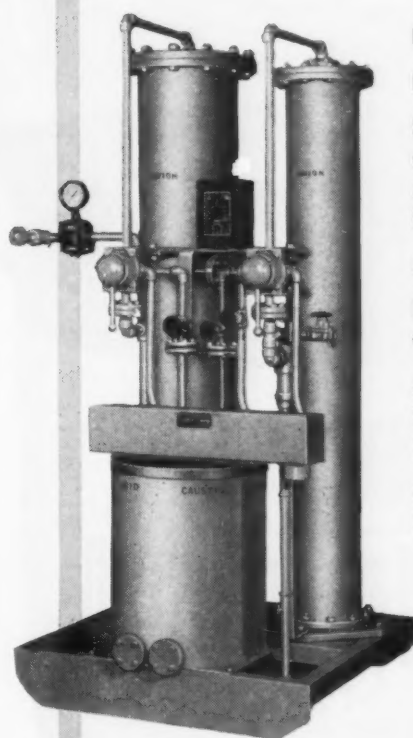


The production of removable rubber drum inserts, under the trade name of "Drumserts," for standard 55 gallon drums was made known recently. These rubber inserts are preformed, independent linings made of ARco-compounded Neoprene or sheet rubber. It is claimed, they can be inserted in any standard drum simply and quickly. The rubber insert is merely set in the drum and the "lip" provided on the insert is lapped over the top of the drum and pulled taut. This permits the insert to grip the drum and maintain a stationary position regardless of handling.

Company engineers state the inserts render any standard 55 gallon drum or barrel capable of holding acids and other corrosive materials. It is claimed that, with these rubber inserts, any drum can be used for electroplating solution makeup; for acid dip, pickle, strip operations; for solution storage; as test tanks, and for laboratory experimental purposes. The rubber inserts can be removed from drums in a matter of seconds by merely peeling the "lip" that laps over the sides of the drum.

Along with these new rubber inserts, the company produces rubber "snap-on" lids for drums.

PRACTICAL APPLICATIONS OF ION EXCHANGE



Demineralization of Water

Deacidification of Solutions

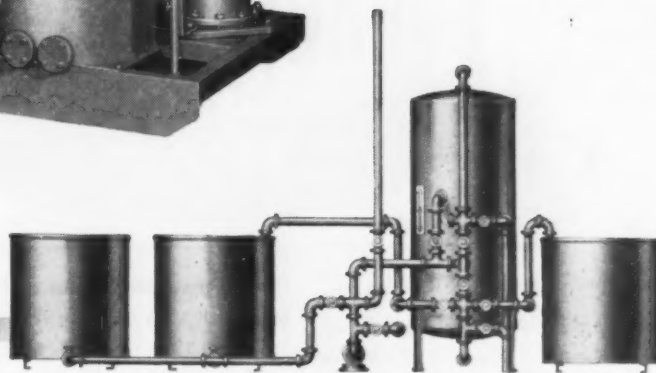
Selective Removal of Troublesome Constituents from Chromic Acid, Plating and Anodizing Baths

Recovery of Valuable Metals

Removal and Recovery of Offending Ions in Waste Waters

Selective Removal of Contaminants from Chromic Acid Copper Stripping Solution

Substitution of Anions and Cations in Solutions



Get Details from INDUSTRIAL

The success stories of ion exchange are not isolated cases. All through industry in a wide variety of applications, ion exchange is effecting substantial cuts in costs, more uniform products, and a new ease in process control.

Here are a few suggestions for you to check against your own processing. INDUSTRIAL is glad to give you the benefit of its experience if you will outline your requirements. An estimate of probable savings, production, approximate costs, and the equipment required will enable you to know what ion exchange can do for you.

4946

INDUSTRIAL

FILTER & PUMP MFG. CO.

5906 Ogden Avenue - Chicago 50, Illinois

PRESSURE FILTERS
DEMINERALIZERS
RUBBER LININGS
HEAT EXCHANGERS
CENTRIFUGAL PUMPS

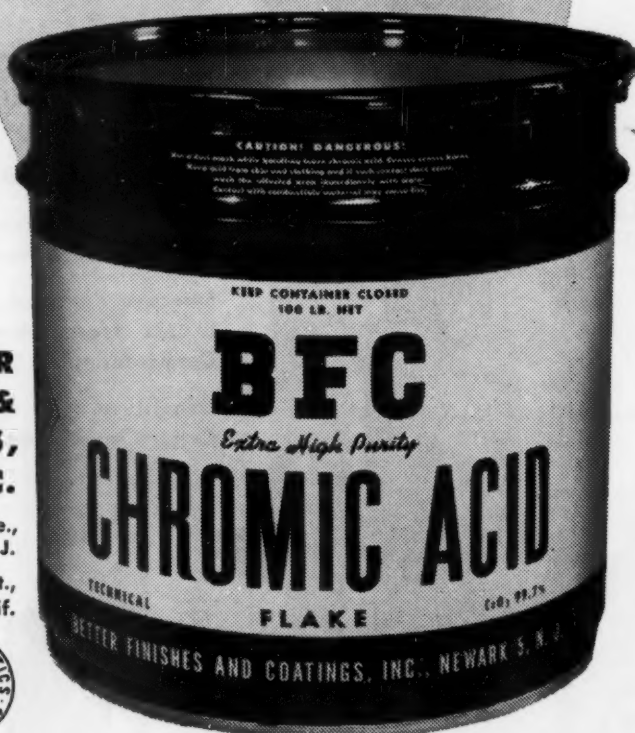
Extra—at no extra cost

We offer product-quality above the industry standard, the interested attention of owner-managers and heads-up local service by as fine a line-up of distributors any manufacturer can have.

If these "extras" appeal to you, we'd like to have a modest order when you're in the market. We are sure you'll appreciate the quality of BFC Chromic Acid and the nice, friendly way we do business.

**BETTER
FINISHES &
COATINGS,
INC.**

268 Doremus Ave.,
Newark 5, N. J.
122 East 7th St.,
Los Angeles 14, Calif.



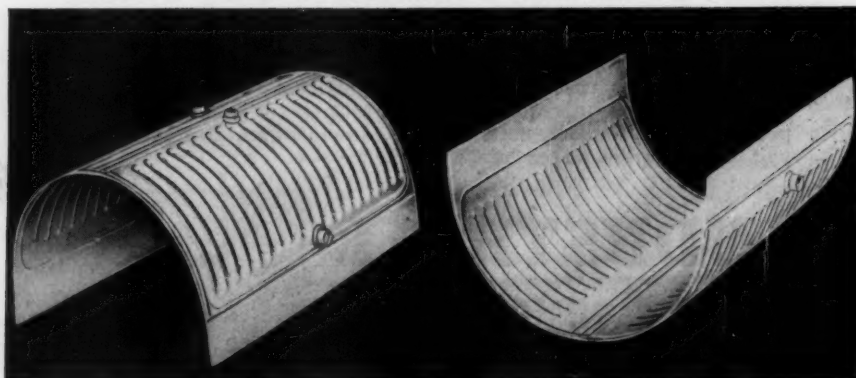
Curved Plate Heaters

Thermo-Panel Division, Dean Products, Inc., Dept. MF, 616 Franklin Ave., Brooklyn, N. Y.

Thermo-Panels, produced by the above firm, are now available not only

in flat plates but in special shapes such as illustrated in the attached photo.

With this type of panel it is possible to place these around tanks, under troughs, etc. The panels are also incorporated in the construction of tanks, where they are used as part of



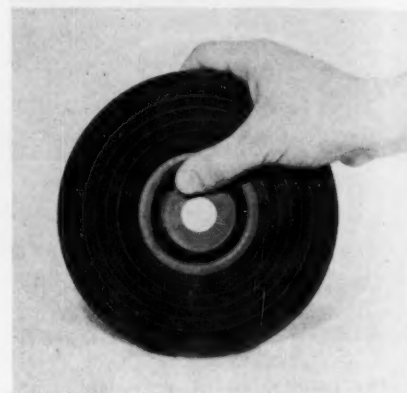
the structural elements of the vessels. They are easier to install and clean than pipe coils.

The panels are also available in special shapes such as L's and cylinders and in a wide range of materials, including steel, stainless steel, Monel and other special alloys.

Complete details and price list may be obtained by writing the manufacturer.

Abrasive Disc

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.



A new depressed center abrasive disc for rough grinding, combining increased cutting ability and safety, called the 3M Type "G", is made of aluminum oxide mineral in a reinforced fabric-and-resin construction which contributes to a faster-cutting and safer operation. It is designed for heavy weld removal, slotting and portable cutoff operations. Both sides and the periphery of the disc can be used for cutting.

The new disc is available in grit 24 in two sizes—7" and 9 1/8"—in "R" hardness. A speed of 5,500 r.p.m. is recommended for the larger size and 6,000 r.p.m. for the smaller size. Other specifications include a 7/8" arbor and an overall thickness of 1/4".

The discs are available nationally from industrial supply distributors and 3M branch warehouses.

Rinse Tank for Barrel Plating

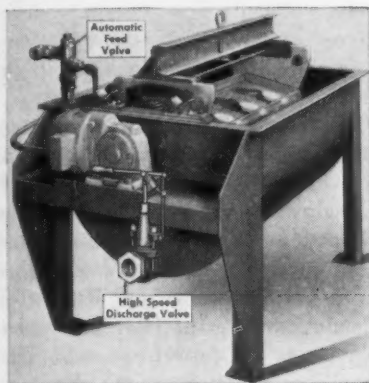
Belke Mfg. Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

The many benefits of clean fresh rinse water are made practical by a new round bottom tank for plating barrels with automatic feed valve and quick-acting dump valve.

With square bottom tanks and fresh water continuously flowing in, the

rinse water never gets clean. The contamination is merely diluted. Flowing through as much as a whole tankful of water removes only half the dirt.

With the new Belke High Efficiency Tank, the fresh water is shut off and the contaminated water is dumped with the quick acting valve. When the cylinder comes in place, the tank quickly refills with fresh clear water. The round bottom means less water to dump, with quicker refill. Complete rinse water change with the improved tank uses much less water and is faster than conventional square tanks with continuous fresh water feed.



The improved rinse tanks can be furnished for plating barrels of all makes.

Rectifiers

Metal Finishing Mfg. Corp., Dept. MF, 89 N. 11th St., Brooklyn 11, N. Y.

The new Placo Rectifier, with exclusive features designed for cool, clean, dependable and economical performance, embodies positive down-draft cooling to keep the entire unit cool and free from dust. Every component part is oversize, with a more-than-adequate stack area, oversize sealed bearing heavy duty fans, fool-proof on-load controls, full overload protection, oversize bus bar internal system, and Placo super-heavy duty transformers.

Latest entry into the field, this rectifier is stated to be the most modern, dependable source for plating and anodizing power, precision engineered for trouble-free performance at peak output and efficiency. Units, available from 25 to 6,000 Amp, 24 Volt, are constructed from the highest quality materials and protected by heavy-duty cabinets.



Technic Industrial 24 Karat Gold is a highly concentrated aqueous potassium gold cyanide, developed especially for industrial gold electroplating. It represents a standard of purity and quality that defies comparison.

Technic Soluble Precious Metals, engineering services and controlled plating equipment also represent the highest standards obtainable. Complete information is available on request without obligation.

TECHNIC INC. Providence, Rhode Island, U.S.A.

The largest enterprise of its kind in the world

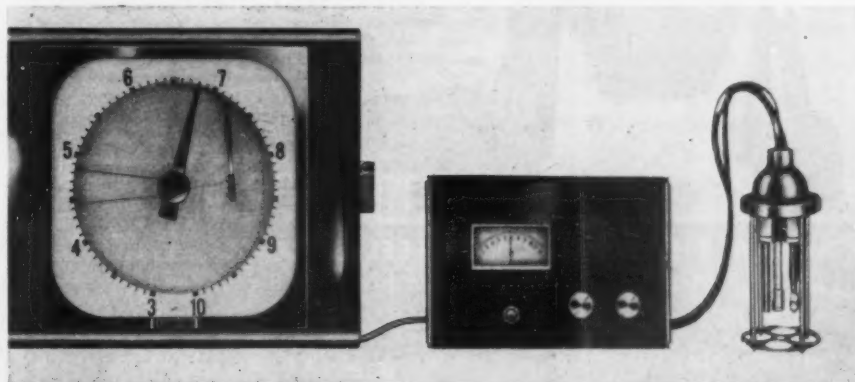
pH Instrumentation Systems

The Bristol Co., Dept. MF, Waterbury, Conn.

Complete systems for pH recording and control, which incorporate for the first time the new Beckman Model W

amplifier, have just been announced.

These pH instrument systems include an Electronic Dynamaster potentiometer recorder or controller, an amplifier, electrode assemblies in either flow or immersion types, and a



★

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Complete Laboratory Control.

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Assistance gladly rendered on Dimensional Allowances or other
Plating Problems. No Obligation. Samples plated without charge.

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variety of final control elements for the addition of gaseous, liquid, solid, or slurried reagents.

The company's new bulletin Q1304 gives full engineering specifications and illustrations of each component of the systems, and shows methods of installing pH instruments in a number of different applications. It also contains photos of installations in various fields of manufacture. The 38 page, two-color bulletin is available on request.

Work Gloves

Edmont Mfg. Co., Dept. MF, 1276 Walnut St., Coshocton, O.

The company has just introduced two new work gloves which, because of their broad applications, are of interest to all types of industries.

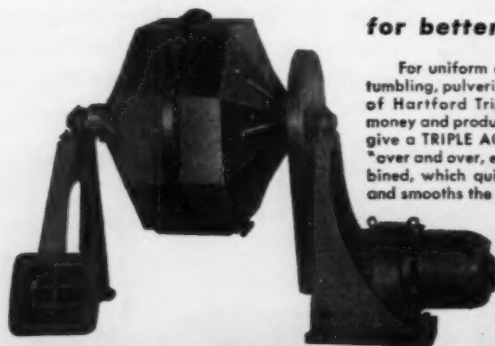
One is called the Plax and is made of fine quality cotton impregnated with vinyl plastic. It fits the hand like a dress glove thereby, providing extreme dexterity for handling or assembling small parts. The plastic treated fabric is very, very durable and has an excellent non-slip grip. They are cool to work in as the fabric breathes. They can be washed without shrinking. These gloves are made in two women's sizes and one size for men.

The other new glove, called the Snorkel is a plastic coated glove with a knitted jersey liner. Its major advantages, over other coated gloves, are extreme flexibility, comfort, seamless work areas and an outstanding grip—wet or dry. The knitted jersey liner.

HARTFORD TRIPLE ACTION

CUTTING and TUMBLING BARRELS

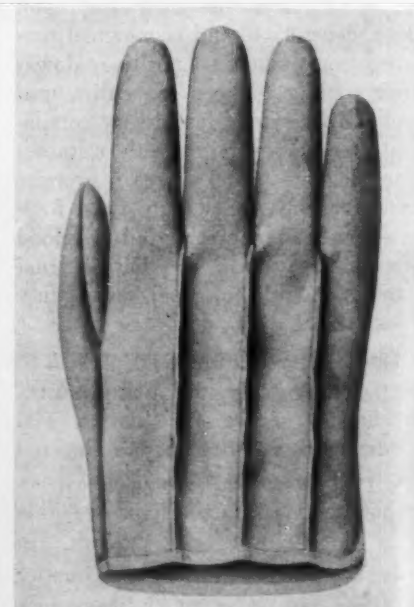
for better work in less time!



For uniform cutting down, wet or dry grinding, tumbling, pulverizing and mixing, the unique design of Hartford Triple Action Barrels saves time and money and produces better results. Hartford Barrels give a TRIPLE ACTION in tumbling the material, an "over and over, end to end, folding-in" motion combined, which quickly grinds off burrs, and finishes and smooths the general surface of any article in the load. These barrels are available in two sizes, large and small, and with both motor and belt drive. Hartford also makes steel burnishing balls scientifically correct in design and material for each specific job. Bulletin on request.

2H552R

DETROIT 2 W. S. TURNER 446 NEW CENTER BLDG.	THE HARTFORD STEEL BALL CO. Hartford 6, Connecticut		LOS ANGELES 15 E. D. MALTBY CO. 1716 SOUTH FLOWER ST.
WICHITA 1, KAN. A. E. WERNER DRAPHEUM BLDG.	CHICAGO 6 VICTOR R. CLARK 505 W. WASHINGTON BLVD.	NEW YORK DISTRICT NEWARK 2 1060 BRUARD ST.	EXPORT OFFICE R. A. RODRIGUEZ, INC. 55 W. 42ND ST., NEW YORK 18
		KANSAS CITY 8, MO. T. R. WHITE 1919 BALTIMORE AVE.	



Plax



Snorkel

made from a 2-piece pattern, accounts for the extreme flexibility. Curved, preflexed fingers and wing thumb add extra comfort and provide a good fit. There are no seams in the work areas which means longer wear. This is a new kind of coated glove that will properly protect working hands—yet give them almost barehanded dexterity and flexibility. They are available in three styles for men—a fully coated knitwrist, a palm coated knitwrist and a 12" fully coated gauntlet.

Zinc Pigmented Coating

Constad Laboratories, Dept. MF,
214 West 29th St., New York 1, N. Y.

Zinktron is a laboratory-developed method of surface protection which is as easily applied as paint right over rusted surfaces. The manufacturer claims that the coating offers all the advantages of hot-dip galvanizing with none of the expense or inconvenience. It is applied with paint brush or spray gun and a gallon covers 450 square feet, taking only one hour to dry.

The product differs basically from other types of metallic paints in that it can be used over rusted surfaces (loose scale removed) and that a galvanic action takes place through the rust. It prevents rust creep due to its mechanical as well as chemical properties. Unlike other rust preventatives, if the coating should be scratched, rust cannot travel underneath. Thus, the user is assured that there will be no "hidden rust" creeping under the so-called protective coating and eating into unseen metals.

When you use Perm-A-Clor for your degreasing operations, you know why Detrex has become industry's largest direct supplier of trichlorethylene. The reason is very simple—you get more for your money!

To begin with, Perm-A-Clor is premium grade solvent. Through Detrex' modern producing facilities and improved techniques, it costs no more than ordinary solvent.

Just as important are the significant savings you enjoy as a result of the Detrex field service organization . . . largest in the industry. This is an automatic, cost-free benefit for all Perm-A-Clor users.

Specifically, a Detrex field technician visits you to check the quality and efficiency of your degreasing operations. Because Detrex produces both equipment and solvent, our technicians understand the behavior of solvent as well as the design and operation of the equipment in which it is used. These specialists know every factor which influences solvent economy—time cycles, parts drainage, control of air-mix solvent vapors, and complete distillation, to name a few.

Training of operators and supervisors is also a regular function. In short, the Detrex service man becomes a technical advisor on your staff whose watchful eye can save you hundreds of dollars per year without fuss or fanfare . . . an established fact in plants the country over.

To measure the value for yourself, let the nearest Detrex technician prove what he can do to cut your degreasing costs, boost your quality. The coupon below will start the wheels in motion, please use it.

I would like the Detrex Field Technician to point out ways to cut my degreasing costs at no charge to me for the service. Please have him call.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

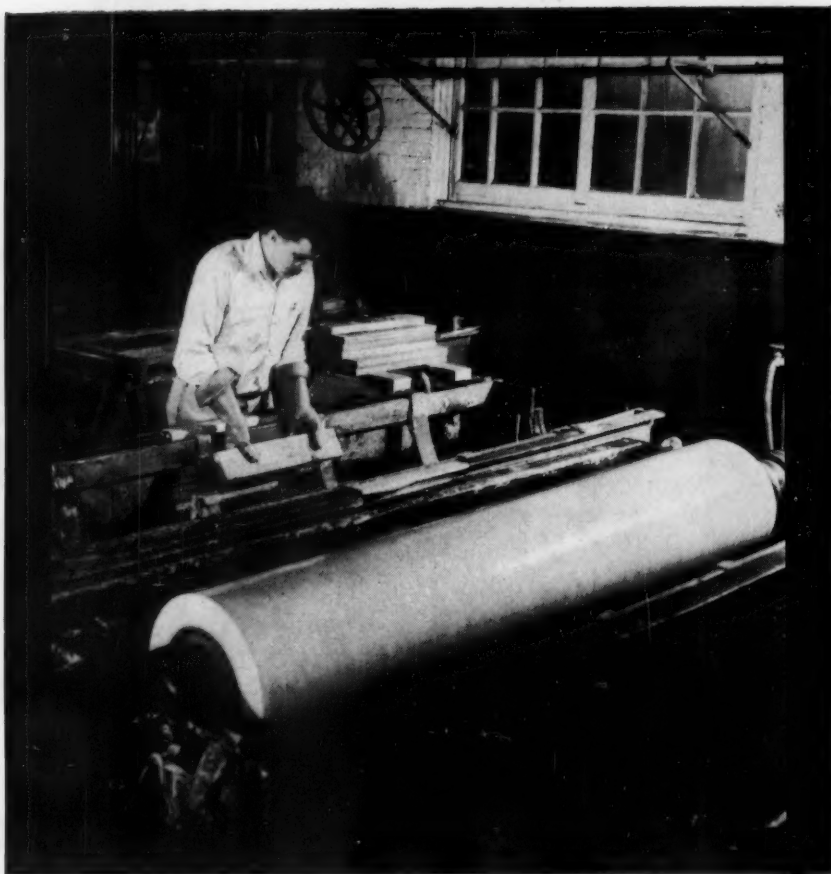
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All conventional sizes and shapes can be supplied. Good service, too, from specialized distributors in your area.

Write for complete 8-page color catalog which gives full data on all anodes in the Federated line. A worthwhile reference piece.

Photo courtesy U. S. Metals Coatings Co., Inc., Elizabeth, N. J.

Federated Metals Division

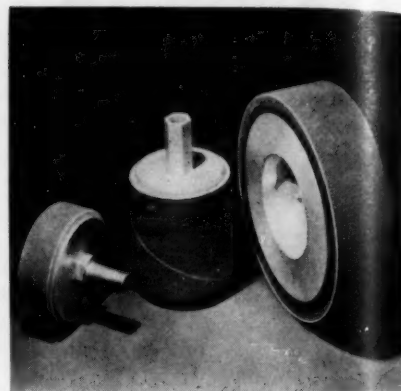
AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

Aluminum, Magnesium, Babbitts, Brass, Bronze, Anodes, Zinc Dust,
Die Casting Metals, Lead and Lead Products, Solders, Type Metals



Abrasive Band Wheels

Even-Cut Abrasive Band Co., Dept.
MF, 8212 Carnegie Ave., Cleveland 3,
O.



Even-Cut rubber-cushioned abrasive band wheels are now furnished from stock in over 50 sizes from $\frac{1}{4}$ " diameter x $\frac{1}{2}$ " width to 6" diameter x 2" width. Matching abrasive bands are available in open, closed and spaced grain coatings in aluminum oxide, silicon carbide and garnet in grits from 24 to 400.

These wheels consist of a plated alloy steel shaft with flanges holding a specially fabricated rubber wheel. Abrasive bands can be quickly and easily slipped over a wheel. As flanges are tightened, the resulting squeezing action against the rubber wheel positively holds the band in position without any tendency to slip or move. Because of the special flange design in relation to the rubber used in the wheel, the abrasive band affords an absolutely straight cutting action for its full width at all times. In addition, the flexibility inherent in the rubber wheel permits fast, accurate cutting or polishing without the use of excessive pressure, the manufacturer claims.

A wide variety of bands are available, including extra-flexible, special resin bonded abrasive types. Bands are all coated accurately to insure uniform operating characteristics. Special lapless construction permits bands to be run in either direction and eliminates fraying of edges.

The Band Wheels are furnished with $\frac{1}{8}$ " or larger round shanks. Adapters are available for male or female threaded spindles. In addition, wheels are also furnished for standard grinding head mounting.

Spray Type Cleaner

Van Straaten Chem. Co., Dept. MF,
546 W. Washington St., Chicago 6, Ill.

A new low priced, highly effective spray type cleaner that combines solvent, wetting agent and alkali as a multi-phase cleaner was announced recently.

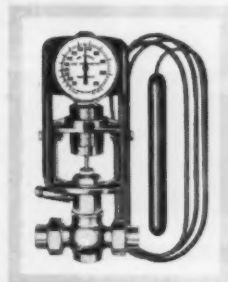
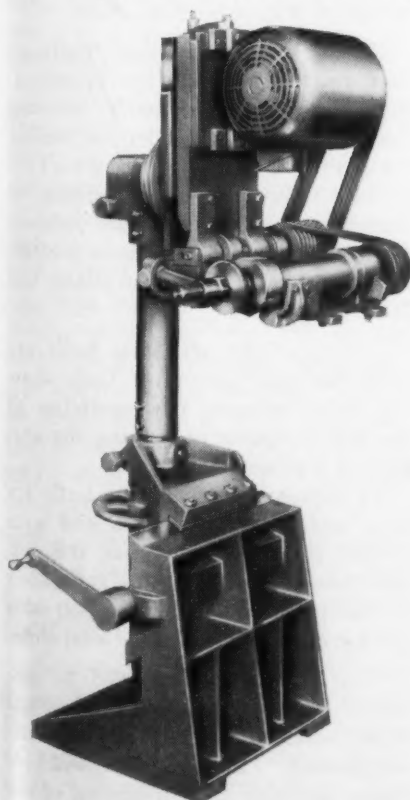
The new cleaner, Vantrol 5618, is especially effective on steel, according to initial use in plants where it has been field tested. In addition to its effective removal of shop and mill oils, drawing compounds and heavy greases, the new industrial washing machine cleaner also has the added values of rust protection, will not coat a machine with the oil removed from the parts, will not clog nozzles or require severe maintenance, is non-foaming and is at least three times faster in cleaning than most cleaners, it is claimed.

The new cleaner is free flowing, non-dusting and non-caking. It is normally used at from one-half to two ounces per gallon. When used at a quarter ounce per gallon in the rinse, it gives steel adequate rust protection.

Polishing Head and Stand Unit

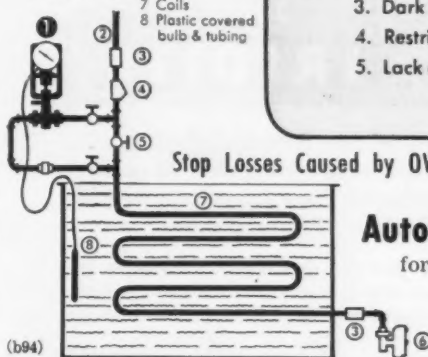
Hammond Machinery Builders, Inc.,
Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

The above manufacturer has recently added another new polishing-buffing



1 POWERS No. 11MF
Self-Operating
TEMPERATURE INDICATING
REGULATOR

- 2 Steam or water supply
- 3 Rubber hose insulators
- 4 Powers self cleaning strainer
- 5 Quick warm up valve
- 6 Powers steam trap
- 7 Coils
- 8 Plastic covered bulb & tubing



Stop Losses Caused by OVER and UNDER Heated Plating Solutions

INSTALL POWERS Automatic Temperature Control

for Copper Plating tanks and other Metal
Finishing Processes. It quickly pays
back its cost by accurately holding
solutions at a constant uniform
temperature.



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Skokie, Ill. • Offices in 60 Cities • See Your Phone Book
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Regulator for _____ (Print name of process or type of plating)

☐ Send Bulletin and Prices on Temperature Control for:

☐ Heat Exchangers ☐ Washers ☐ Degreasers

Name _____ Title _____

Company _____

Address _____
(b94P)

a special message
for
appliance
manufacturers

need a finish
that blocks corrosion by
itself—or under paint?

specify

IRIDITE

You can solve any problem of non-ferrous finishing . . . maximum corrosion protection . . . sparkling clear or colored decorative finishes, firm and lasting base for paint . . . with these two words—"specify Iridite". For example—

● **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

● **ON COPPER** . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

● **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

● **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

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Manufacturers of Iridite Finishes for Corrosion Protection and
Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals,
WEST COAST INCORPORATED, L. H. Rutter Co.



Iridite is
approved
under
government
specification

head and stand unit to their wide line of finishing machinery, which is designated the Model 50-99.

This head is powered by a 3, 5 or 7½ H.P. 1,750 R.P.M. motor or a 10 H.P. 3,500 R.P.M. motor. It is built to "stand the gaff" of medium duty polishing or buffing operations. Net weight over 1,400 lbs. assures vibrationless operation, resulting in uniformity of finish on parts being processed.

A maximum "float" action of 4" allows the head to follow the surface of irregular parts. Flat surfaces can also be finished without using the floating action. Power wheel feed can be furnished, which enables the machine operator to maintain correct pressure, and the head is equipped with an ammeter as standard equipment. Periodic reading of the ammeter takes the guesswork out of the work the head is doing, thus uniform results are assured.

Sisal Buffs

Hanson-Van Winkle-Munning Co.,
Dept. MF, Matawan, N. J.

The above manufacturer announces four major improvements in its sisal buffing wheels that make for longer wear and faster cutting. The improvements include: 1) treatment with an impregnating material, 2) new center construction, 3) improved sewing and 4) use of a stronger sisal cloth.

Called Binderized Bias Sisalweev Sections, the new buffs are impregnated with the same organic material that is used as a binder in buffing compositions. The impregnated "binder" improves the adherence of composition to buff, besides lubricating and making the buff more flexible. With the binder, buffs cut faster, last 30% longer.

Centers of the new sisal buffs are made flat and plain now. Tests show that this eliminates the possibility of the buff streaking or ringing the surface of a piece of work.

To improve wear, the new buffs are sewn under greater tension and with heavier thread. Besides that, the outside row of sewing is now run closer to the periphery of the wheel; this gives greater strength to the sisal cloth.

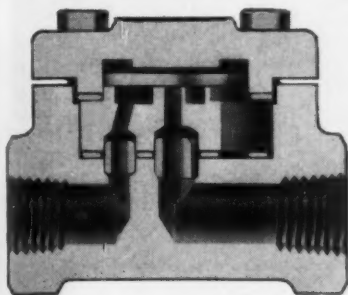
Wear is further improved by the use of a woven sisal cloth that has been mangled—heavily rolled and compressed. Final improvement includes precision knife-trimming of the

periphery to produce a finer and sharper-cut edge.

Sections $\frac{3}{8}$ " thick with either 5" or 7" centers, untreated or treated with the Binderizing process, are available in a full range of sizes. Spiral sewing can be applied with spacing as desired.

Steam Trap

Sarco Co., Inc., Dept. MF, Empire State Bldg., N. Y. 1, N. Y.



In this new and very different steam trap, the kinetic energy of steam closes the valve. The manufacturer's claim of trouble-free operation is based on the fact that the new operating principle permits an extremely simple design, free of the usual valve mechanisms, devices, fragile parts and narrow channels.

The only moving part is the unique valve head, a solid heat-treated stainless steel disc insures practically no maintenance according to the manufacturer. Furthermore the same head and seat are used for pressures to 600 p.s.i., temperatures to 950°F.

Operating characteristics of the Thermodynamic trap are listed as follows: closes tight on no load, and operates against a back pressure up to 50% of its inlet pressure. Discharges condensate at saturated steam temperature as rapidly as it forms. This trap can vent large volumes of both air and air-steam mixtures. The starting load capacity is very high, but it operates equally well with light loads or no load. The trap is designed to work just as efficiently at 1 p.s.i. as at 600 p.s.i.; it is not affected by pressure variations.

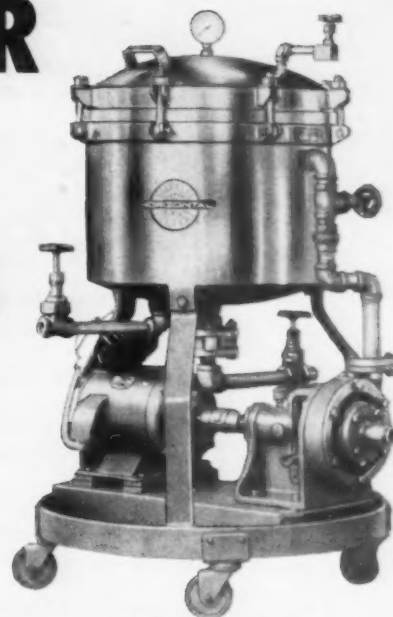
The design and metals used enable this new steam trap to withstand superheat, water-hammer, vibration and corrosive condensate.

The trap is extremely compact: the 1" size is only $3\frac{1}{2}$ " x $4\frac{3}{4}$ " x 4" high. Bodies are of cast semi-steel, carbon or moly steel with screwed, socket weld or flanged connections.

SPARKLER HORIZONTAL PLATE FILTERS

FOR LOW COST FILTERING
OF PLATING SOLUTIONS
AND CARBON TREATMENT
WITHOUT SHUT DOWN

HERE'S HOW



Sparkler Plating Filter
Model 18-D-6 Alliron
600 G.P.H. Portable

On a horizontal filter plate it is possible to apply a thin pre-coat with about one-third the filter aid, and in one-third the time required for pre-coating a non rigid media or a surface in a vertical position. This saves time and filter aid.

Where several tanks are to be filtered, the Sparkler filter can be shut down after filtering the first tank and moved to the next one without danger of disturbing the filter cake. This saves pre-coating time and filter aid usually required to re-coat a bag-type filter.

A filter cake on a horizontal plate will not crack, slip or fall off even with varying pressure or a complete shut-down of the filter. No pre-coat renewal is ever required after an interruption in operation.

When it is necessary to clean the filter, the Sparkler filter tank can be emptied in a matter of minutes with a minimum loss of valuable plating solution.

Any grade of filter paper from fine to coarse can be used in a Sparkler filter. This makes it ideal for carbon treatment of solutions. Carbon mixed with water in a stand-by tank is circulated through a clean set of filter paper on the plates until a carbon cake is formed. The solution requiring carbon treatment is then circulated through the carbon beds without contaminating the plating tank or a shutdown of plating operations.

At the end of the cycle with a Sparkler filter you can blow-down with air and produce a relatively dry cake that can be disposed of in a trash can rather than washing it down the drain with attendant sewer clogging problems.

You will find your Sparkler plating filter positive and dependable from a standpoint of uniform high quality filtering and economical in labor and material.

Write Mr. Eric Anderson
for personal service.



Sparkler representatives in all principal cities are ready to give you personal service on your filtering problems, and show how you can make a material saving in operating cost.

MANUFACTURING COMPANY

Mundelein, Illinois

SPARKLER INTERNATIONAL LTD.

Canadian Plant, Galt, Ontario
European Plant, Amsterdam, Holland


CrO₃

In deciding upon the brand of Chromic Acid to use, successful platers consider three factors:

- 1 — Purity of the product as indicated by the assay and maximum limits of impurities.
- 2 — Experience and technical competence of the producer.
- 3 — Reliability of the manufacturer as demonstrated during periods of shortage.

More Mutual Chromic Acid is used than any other brand because the metal finishing industry has found Mutual's record to be outstanding on all three counts.

CHROMIC ACID · SODIUM BICHROMATE
POTASSIUM BICHROMATE


 SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA
Mutual Chromium Chemicals
99 PARK AVENUE · NEW YORK 16, N. Y.

Barrel Finishing Media

*The Exolon Co., Dept. MF, 945 East
Niagara St., Tonawanda, N. Y.*

The success of this barrel finishing abrasive is due to its toughness and its hard abrasive surface. It is made in an electric arc furnace from bauxite



A new abrasive product for barrel finishing is made from selected grades of aluminum oxide and processed to remove all sharp edges which might scratch the work. Sizes range from two inches down.

which is melted and forms hard aluminum oxide crystals with facets in every conceivable direction.

Constant use of the material does not impair the abrasive quality, but does somewhat reduce the size.

Jet Siphons

*Carl Buck & Associates, Dept. MF,
Essex Fells, N. J.*



Illustrated are two sizes of Camac acid proof plastic jet siphons for emptying waste acid from tanks and sumps. The plastic is fiberglass-reinforced Furacam which is not attacked by acid or alkaline solutions except strong chromic or nitric acid. Nozzles are sized for standard acid hose and the unit is easily disassembled for cleaning.

Two sizes are available: Size No. 3 has a capacity of 1,200 G.P.H. and Size No. 6 is rated at 4,000 G.P.H. with 20 lbs. steam. Operation is possible with steam from 10 P.S.I. to 50 P.S.I. Literature and prices are available from the manufacturer.

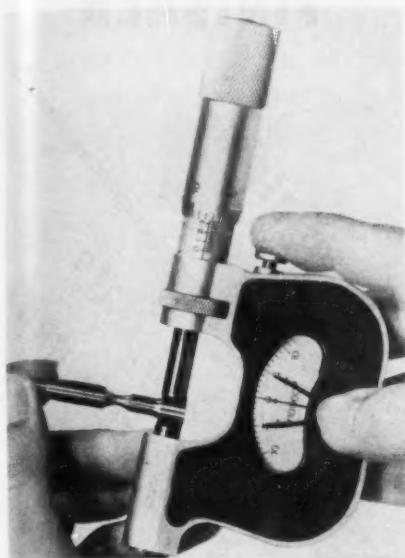
Indicating Micrometer

*George Scherr Co., Inc., Dept. MF,
200 Lafayette St., New York 12, N. Y.*

An indicating micrometer providing "Visible Feel" to the user and having a range from 0-1", reading in .0001" has been recently announced.

"Tenths" are easily and unmistakingly read from an extra large dial. The indicating mechanism controls the measuring pressure so that all uncertainties due to differences in "feel" of individuals are eliminated. The Master Compar indicating micrometer really offers what its name implies, namely a master-micrometer and a comparator combined in one instrument. In addition, this tool provides the user, due to its ingenious design, with a complete set of Go and No Go Gages of one inch range, reading in .0001". A most important feature is

that it detects Out-of-Roundness, Ovalness and Taper. The fact that the release button for the movable anvil is



on the right hand side makes it a right hand tool, enabling the operator to hold it the conventional way.

Radically new is the resetting to zero which is accomplished by means of a screw on the bottom of the housing and can be done accurately in less than 5 seconds. Heavy tungsten carbide anvils and finished hardwood case are standard equipment. Larger sizes up to 4" are furnished with removable indicator. The price for the 1" size is \$95.00.

Felt Bob Assortment

Bacon Felt Co., Dept. MF, 427 West Water St., Taunton, Mass.

A new assortment of Paramount Brand felt bobs packaged in a box that doubles as a handy bench-top holder for the bobs when they are not in use is now available.

The bobs in the K-1 assortment are mounted on 1/8" mandrels and include 12 plain shapes, consisting of four sizes each in soft, medium, hard and rock hard, and 16 standard shapes, also in four sizes each in four degrees of hardness. In addition, the assortment includes 36 wheels in assorted sizes and densities, a 1/8" mandrel on which the wheels may be mounted, and six 2" x 2" squares of rubbing felt for final hand finishing touch-ups.

The unique and colorful package for the bob assortment is designed to be kept right on the workbench as a holder for bobs and wheels when they are not in use. The attractive transparent cover, of double-thick clear acetate,

FORMAX

the Perfect Combination
FROM START
TO FINISH

ZIPPO CLOTH BUFFS

BUFFING COMPOUNDS

ZIPPO SISAL BUFFS

These famous long-wearing buffs run cool under all buffing conditions. High count bias-cut cloth is assembled on ventilated steel centers. Each section is perfectly balanced and faced—requires no raking.

Formax produces a complete line of buffing compounds in bar, tube and liquid form. Our extensive manufacturing, laboratory and testing facilities are at your disposal.

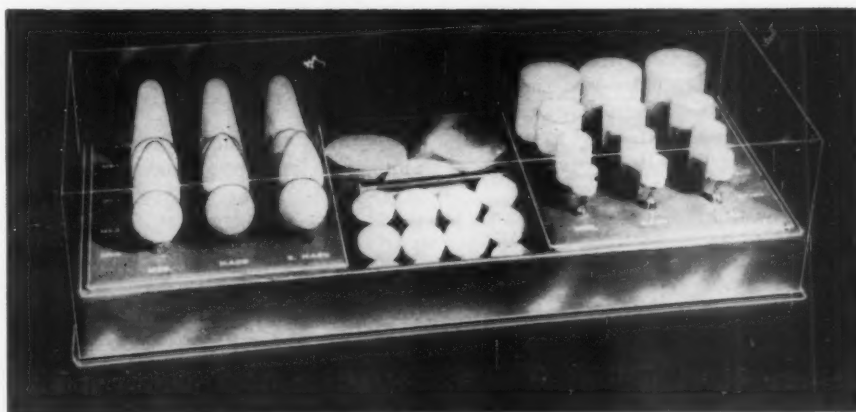
You have a pleasant surprise coming if you haven't tried the new Zippo bias-type sisal buff. It was specifically developed for steel buffing—to blend polishing grit lines—to cut down stainless steel—and bring up a bright lustre.

Other Formax products include the well-known C-20 Flexible Contact Wheels and F-26 Abrasive Belt Grease Stick.
Descriptive Catalogs Sent on Request

FORMAX MFG. CORP.

DETROIT 7, MICHIGAN

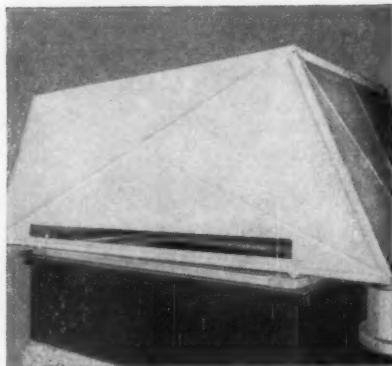
"THE FOUR McALEERS"



serves to keep the bobs free of dust and dirt and also makes it easy to determine at a glance which bobs are missing or worn.

The complete package, consisting of 54 pieces, sells for \$10.95 which is considerably below the price of the units when purchased separately.

THIS PLA-TANK® HOOD SAVED ITS COST IN A YEAR



The PLA-TANK Hood shown above has been in continuous use at General Electric's small aircraft engine department in West Lynn, Mass., for over a year. Reports indicate that it is still as good as when originally installed, is already credited with saving its entire cost since no previously used material had lasted over a year.

The tank is used for etching stainless steel billets; solutions used are aqua regia at room temperature and a 50% solution of muriatic acid at 180°F. PLA-TANK has successfully withstood these fumes, where other materials failed.

PLA-TANK products are daily solving problems of all types in the chemical and electroplating fields. They replace or outlast stainless steel, lead and ceramic linings, plywood coated with corrosion preventatives, phenolic plastics and asbestos cement board structures in many applications.

PLA-TANK, molded from long-life, resin-bonded glass fibre laminate, is now resistant to a wider variety of fumes and temperatures than ever before. PLA-TANK is light weight, easy to install, competitively priced.

Let us help you solve your problems the modern way — with PLA-TANK. Write today for free data sheets.

P-21



BUSINESS ITEMS

Baxter Appointed by
Richardson Allen



Andrew H. Baxter

Richardson-Allen Corp., College Point, L. I., N. Y., manufacturers of selenium rectifiers, chargers and electronic specialties, have appointed *Andrew H. Baxter*, 412 Albee Bldg., Washington, D. C., to represent them in sales throughout the District of Columbia and in Maryland and Virginia.

Mr. Baxter, after graduating from the University of Pennsylvania, concluded a course in electrical engineering at George Washington University. He began active selling in the lighting fixture industry and followed this up with specialization in sales representation, later becoming established in his own business as manufacturers' representative.

MacDermid, Inc. Appoints Representative

MacDermid Inc., Waterbury, Conn., announces the appointment of *Walter A. Dyber* as technical sales representative in the "Berkshire Territory." Mr. Dyber will service customers in Winsted, Torrington, Springfield, Pittsfield, Holyoke and Northern New York State. In addition, he will service a number of accounts in the Hartford area.

Mr. Dyber was formerly associated with Pratt & Whitney Aircraft, having served this company as supervisor of finishing. He also served in "Plant & Plating Room Layout," and "Process

Du-Lite FINISHED



The Marlin Firearms Co., "Famous for Fine Guns since 1870", has long depended on Du-Lite black oxide for an attractive finish that will be dimensionally stable throughout the life of the gun.

The Du-Lite process provides intricate precision parts with a durable, rust-resistant black oxide finish. And since Du-Lite penetrates the metal, all crevices and knurls are protected without affecting dimensions or fit.



If your target is durable, attractive, economical finishing, you'll want to know more about Du-Lite black oxide.

Whatever your cleaning or finishing problem—**Depend on Du-Lite.**

Write for complete information.

DU-LITE CHEMICAL CORP.

MIDDLETOWN, CONN.

- ☐ Send more information on Du-Lite.....
- ☐ Send information on metal finishing products..
- ☐ Have your representative call.....

Name.....

Company.....

Address.....

City..... Zone..... State.....



Development." His eighteen years in the above capacities, qualifies Mr. Dyber to service any and all plating and metal finishing operations. A member of the Hartford Branch A.E.S. and the S. & P. A., Dyber will make



Walter A. Dyber

his headquarters in his home in Manchester, Conn. He has had articles published on "Aircraft Engine Overhaul Techniques" and has acquired a thorough knowledge of MacDermid products after spending 2 years in the company laboratory in Waterbury.

New Pilot Plating Plant for Stevens

Another improvement in *Frederic B. Stevens, Inc.*, customer service program, a new pilot plant for experimental zinc, cadmium, copper and nickel automatic barrel and conventional plating, is now in operation. The new pilot plant is also designed to provide study and analysis in the problem of metal finishing waste disposal.

Helping in the establishment of the new pilot plant was *Victor G. Matosh* who recently joined the company as plating service engineer.

Prior to joining Stevens, Matosh was with *Burroughs Corp.* for two years as an electrochemist in the plating laboratory. Before that he worked with *Houdaille-Hershey Corp.* and *Ford Motor Co.* as a chemical engineer in the inspection laboratory and as a process control observer in the engineering department.

Matosh graduated with a B.S. in Chemical Engineering from *Lawrence Institute of Technology*, Highland Park, Mich., after serving three years with *U. S. Army Ordnance*.

GOOD PLATING IS VITAL!

MEAKER

PLATING MACHINES

HELP YOU GET IT

Facts....

YOU SHOULD KNOW ABOUT THE MEAKER DESIGN

Semi-automatic and full automatic plating machines justify their cost, usually in a surprisingly short time, by savings in man power, floor space, and by eliminating the cause of many undesirable conditions in the plating room. Meaker machines fulfill the most exacting requirements and have demonstrated their extremely low maintenance cost over the years.

Meaker machines are designed for maximum flexibility, lending themselves to changes in product and processing techniques. A simple and positive adjustment provides for variations in production or plating specifications.

For the occasional job where a special and complicated treatment is needed requiring an intricate handling function, which even a unit as flexible as the Meaker machines cannot provide, our engineers, drawing on more than fifty years' experience in this field, will carefully analyze the problem and design equipment to satisfactorily accomplish the desired results.



Write for your free brochure of Meaker Equipment for plating, anodizing, pickling, bonderizing, and other processing. Contains numerous illustrations of plating machine installations, construction features, application information and operating tables.

THE MEAKER COMPANY

1635 SOUTH 55th AVENUE • CHICAGO 50, ILLINOIS • Phone OLympic 2-2110

- Full Automatic and Semi-Automatic Plating Machines
- Wire Galvanizing Equipment
- Processing Conveyors
- Strip Steel Plating Equipment
- Batch Type Plating Machines
- Motor Generators for Plating
- Pickling Machines
- Rectifiers for Plating

Whitfield Chemical Appoint Merriman

The appointment of *Fredric E. Merriman* as a sales engineer for the *Whitfield Chemical Co.*, 14225 Schaefer, Detroit, Mich., has been announced by *C. Whitfield Smith*, company president. His territory will include parts of Ohio, Pennsylvania and New York.

A native of Hartford, Ohio, Merriman will remain located in that city. He attended Ohio State University.

6 Wyandotte Chemicals Representatives Awarded 25-Year Service Watches

Six J. B. Ford Division representatives of *Wyandotte Chemicals Corp.* recently received 25-year service watches, including *Fred Tholen*, well known sales manager of this Wyandotte, Mich., organization.

From left to right, front row, they are: *Ford Ballantyne, Jr.*, vice-president Wyandotte Chemicals—general manager J. B. Ford Division, who helped present the watches; *Mrs. Evelyn Allen*, secretary to Mr. Ballantyne; and *Fred Tholen*, sales manager.



Standing: *Keith L. Boyd*, Harrisburg, Pa.; *Charles T. Dumont*, Cincinnati; *Morgan J. Canniff*, Philadelphia, Pa.; and *William J. Wilson*, Montreal. A banquet honoring the 25-year

watch receivers and their wives and husbands was held in the Wyandotte Chemicals Club and was attended by over 450 employees and executives. Nearly 900 of the more than 1,900

BEAM-KNODEL CO.

Metropolitan Distributors
HANSON-VAN WINKLE-MUNNING CO.



Complete Service for Metal Finishing

Products Listed Below Available in New York
Stock With Reasonable Exceptions

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Anodes, All Kinds
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Acme White Finish

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Rouge
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Glue

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FILTERS

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PRODUCTS

UDYLITE SERVICE DOESN'T COST—IT PAYS

These are cost cutting days—and it will pay you to investigate Udylite's free services to the plating industry.

OUR FIELD SERVICE STAFF IS LARGE

In fact, largest in the electroplating field. That means you get frequent service check-ups. We maintain Udylite equipment at top performance. It's all free, of course. Just another plus when you buy from Udylite.

WORLD'S LARGEST
PLATING SUPPLIER

THE
Udylite
CORPORATION
DETROIT 11, MICHIGAN



For PLATERS, SILVERSMITHS, JEWELRY MFGRS., makers of Watches, Clocks and Electronics and other metal finishers. Supplied in straight or crimped brass, steel, nickel silver or stainless steel wire in sizes .0025 - .006 and in bristle, fibre or Nylon. Special sizes and shapes to order.

Write (Dep't. M) on your letterhead for catalog and price list.

DIXON & RIPPEL, INC.

KINGSTON, N. Y.

company employees who have to date received 25-year watches are still in active service.

Gerity-Michigan Corp. Installs One of the World's Largest Automatic Plating Machines

In order to handle increased automotive plating business booked *Gerity-Michigan Corp.* has installed a huge fully automatic double plating machine embodying the most advanced and modern developments in electroplating. Parts ranging from large front grilles to smaller ornamental and decorative items, which will be on many of the popular 1955 model automobiles, will be automatically plated by the machine.

The new machine is 160 feet long, 9 feet wide and 16 feet high. It consists of a series of 29 tanks ranging in size from 2½ feet to 140 feet in length. The copper plate tank has a solution capacity of 22,000 gallons, a nickel plating tank of 9,000 gallons and a chrome tank of 1,650 gallons. It has a power requirement of 65,000 Amps. at 6 Volts, yet requires only one 20 H.P. motor to activate the entire machine. The water requirements are 2,000 gal-

lons per hour. It is strictly automatic and can be set at any plating speed.

New Plant for Lea-Michigan, Inc.

Lea-Michigan Inc., 14066 Stansbury Ave., Detroit, Mich., one of four companies comprising the Lea Group of finishing specialists, is now occupying a new factory where it is manufactur-

ing a number of Lea products used in connection with plating, polishing and buffing.

Present floor area of the plant is 7,200 sq. ft., which is so arranged as to permit easy expansion. Part of the present building is being made into a fully equipped laboratory where the company will analyze customers' solutions and plating baths.



*A barrel load of
bright nickel
with a nickel's
worth of*

NICKELITE

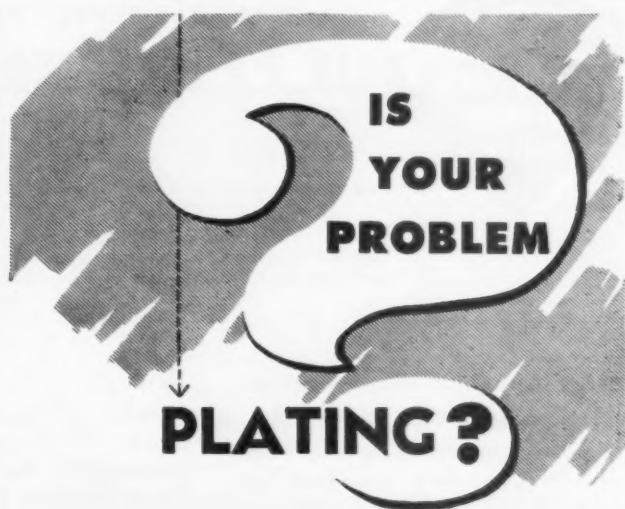


Cut your barrel nickel brightening costs with Nickelite brightener — Concentrated to quadruple strength, you don't ship, store or handle water! Shipping weight is cut 275%. No deposits, no carboy returns. A capfull is enough for a barrel load of nickel. Stable at high temperatures, not filtered out in processing — replenishments are kept low. Nickelite cuts cost all the way!



Nickelite boosts corrosion resistance 30 to 100% by actual salt spray tests. Get 13 to 22 hours with 0.00006 inch — instead of 11 to 13 hours without Nickelite. Even greater improvement with thicker deposits.

59 EAST FOURTH ST.
NEW YORK 3, N. Y.



HOLLAND SUGGESTS:

Motor Driven Tank Rod
Agitators. Single or Double
arms.

Write for NEW 1954 Holland Catalog
— illustrating important material for
the metal finishing industry.

J. HOLLAND & SONS, INC.
475 Keap Street (corner Union Ave.) Brooklyn 11, N. Y.

FOR SUPER THROWING POWER IN CHROME PLATING...



Heil 3/4" Sawtooth Anodes with Plastic Coated Protected Hooks

Use HEIL Lead Anodes

YOU GET MORE LEAD PER DOLLAR FROM
SAWTOOTH, FLAT, HERRING BONE,
AND SPECIAL SHAPED HEIL ANODES.



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HEIL Products are Sold Through Leading Electroplating Jobbers

OTHER HEIL PRODUCTS INCLUDE: Lined Plating Tanks •
Nocordal® Impervious Graphite Heating Units • Rigid Plastic Duct •
Lined and Coated Blower Sets • External Exchangers • Lined Pipe

*Trademark

Detrex Appoints Vice-President

T. Kenneth Haven, former executive vice-president of Reichhold Chemicals, Inc., has been appointed vice-president of the Detrex Corporation of Detroit, manufacturer of chemicals and metal-cleaning machinery.

A. O. Thalacker, Detrex president, said Mr. Haven's assignments will include the study of proposed expansion programs in this country as well as foreign trade investigations and their ensuing operations. His appointment is effective as of Nov. 1.

One of the best-known members of Michigan's financial community, Mr. Haven was associated with Reichhold for 12 years as executive vice-president, general manager and director.

He is also a founding director of the Ferndale (Mich.) National Bank, a director of Temprite Products Corp., Birmingham, Mich., and a trustee of Grace Hospital, Detroit.

Mr. Haven received his A.B. degree from the University of Michigan in 1928, his M.B.A. the following year, and his Ph.D. in 1940. From 1930 to 1936, he was a member of the staff of business research in the Business Administration School at the University of Michigan, where he also taught a graduate course in corporate finance.

From 1936 to 1942, he was manager of the Underwriting Department of Watling, Lerchen and Co., Detroit, Mich.

A world traveler on many occasions, Mr. Haven has had wide experience



T. Kenneth Haven

abroad, as well as in the United States, in corporate financing, mergers, and plant construction.

French Group Pays General American Transportation Corp. Half Million for Process Rights

William J. Stebler, president of General American Transportation Corp. (Chicago) has announced that the company has signed a contract, with a half-million dollar rights payment, with the Societe Europeenne de Revetement Chimique (S.A.) licensing that company exclusively to use and to sub-license the Kanigen "electroless" nickel plating process in several countries and territories abroad. The Societe, a new company to be known as Seurec, is composed of ten well-established French industrial firms.

Mr. Stebler stated that Seurec's initial fee of \$500,000.00 covers rights to the process, and continuing royalties will be paid, based upon pounds of nickel deposited by Seurec and its sub-licensees, during the next 20 years. One-half of any sub-licensing fees received by Seurec will also be paid to General American. The license and sub-licenses include the right to use the registered trade name Kanigen.

The exclusive arrangement, with sub-licensing rights, will cover the use of the process in France, the French Union, Morocco and Tunisia; also Belgium, the Netherlands, Luxembourg, Saar, West Germany, Spain, Portugal, Switzerland, Italy, Sweden, Norway, Finland, Greece, Austria and Yugoslavia, and the respective possessions, territories, mandates and protectorates of each thereof, excepting those

lying within the Western Hemisphere.

Seurec will proceed immediately to install a pilot plant at Etablissements Studler in Paris, which will also be the first licensee for a commercial plant. This will be followed promptly by the installation of other commercial plants and the granting of other sub-licenses. All technical and operating data developed by General American will be made available and there will be an exchange of technical personnel. The French organizations included in Seurec are:

Societe l'Aluminium Francais
M. Bertolus
Compagnie Generale d'Electro-Metallurgie
Etablissements Delattre et Frouard
Etablissements Fauvet-Girel
Forges et Ateliers de la Loire
Societe Le Nickel
Societe Simotra
Etablissements Studler
Etablissements Cail

J. Frank Daly Represents Wyandotte Chemicals in Hartford

J. Frank Daly, well known in New England for his industrial training programs for the War Manpower Commission, is resident representative in Hartford, Conn., for Wyandotte Chemicals Corp.

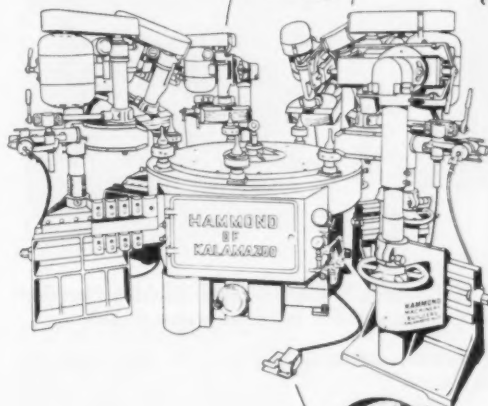
Mr. Daly is a graduate of Holy Cross and Trinity Colleges, and has taken advanced courses at Yale. He has many years experience in New England and New York State servicing users of industrial cleaning and processing materials. He joins George Haas and Edward Rolfs in bringing Wyandotte service to New England metal processors.



J. Frank Daly

America looks to . . .

Hammond
for
**FINISHING
and
DEBURRING**
"KNOW-HOW"



SEND SAMPLES and we will show you how much you can speed up production and cut costs.

Hammond
Machinery Builders INC.

1601 DOUGLAS AVE. • KALAMAZOO, MICH.

The experience gained in over 70 years of machinery building has provided us with a big bank of "Know How."

This knowledge is drawn upon and added to every day. Our business is to share it with you to bring down high finishing costs. Many users of Hammond Automatics have found more efficient means of finishing by drawing on our bank of "Know How."

The Rotary Automatic illustrated represents one of our many types and sizes of automatic finishing machines for either continuous rotation or indexing. The head and stand units shown are a part of a large "family" which range in type and size up to 20 HP.

New Appointments at Diamond Alkali

Dr. Albert W. Meyer, in charge of the U. S. Rubber Co.'s New Materials Department at Passaic, N. J., for the past three years, has been appointed to the newly-created position of Director of Exploratory Research for Diamond Alkali Co., it was announced by President John A. Sargent.

The new organizational arrangement also advances two Diamond research veterans. C. C. Brumbaugh, becomes director of research, Atomic Energy, Alkali and Electrolytic Products. Thornton F. Holder, patent counsel for the company for the past eight years, now becomes research coordinator and

patent counsel. Both posts are newly created.

C. T. Haller Appointed Head of Inco's Pittsburgh Technical Field Section

C. T. Haller, Jr., has been appointed in charge of the Pittsburgh, Pennsylvania, Technical Field Section of the Development and Research Division of The International Nickel Co., Inc., it was announced by Donald J. Reese, assistant manager of the division.

Mr. Haller, whose appointment became effective November 1, 1954, succeeds William H. Sparr, Jr., who has been transferred to New York and appointed in charge of the Steel Sec-

Entirely New Filter Design!

Sel-Rex DOUBLE DUTY FILTER



DOUBLE VOLUME New Sel-Rex Annular Type principle doubles filtration area and volume without increasing size of unit.

DUAL PURPOSE Efficient low-cost operation with either cloth bag or porous stone.

EASY OPERATION and MAINTENANCE

- Entire filter element secured to tank cover... simple inspection and cleaning.
- Extra capacity precoat tank.
- Colored operating valves located at front of unit permits operation by unskilled help.
- Horizontal hose connections eliminates danger of leaks and ruptures.
- T-valve permits clean changeover from precoat to filtering.

Sel-Rex Filters available in standard sizes (Portable or Stationary models) 175 sq. ft. area. Larger units designed to specifications.

BART-MESSING CORPORATION

Dept. MF-12, 229 Main Street

Belleville 9, N. J.

tion of the company's Nickel Sales Department.

A metallurgist, Mr. Haller joined the company in January, 1945, as a member of the Pittsburgh Technical Field Section. He was appointed in charge of the Cincinnati, Ohio, Technical Field Section in 1951.

A Master of Science graduate of the Carnegie Institute of Technology, Mr. Haller before joining Inco was with the Carnegie Illinois Steel Corp., Pittsburgh; Latrobe Electric Steel Co., Latrobe, Pa., and the Metals Research Laboratory of the Carnegie Institute of Technology as a metallurgist.

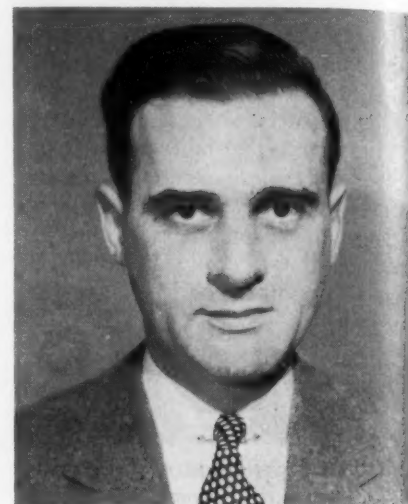
Diamond Alkali Adds to Muscle Shoals Plant

First step in getting the Muscle

Shoals Chlorine—Caustic Soda Plant of *Diamond Alkali Co.* into production by January 1, 1955, was taken on Nov. 2, as the company awarded a contract to Leonard Construction Co., Chicago, for rehabilitation and construction of certain additions to the plant and equipment.

Recently purchased by Diamond from the government, the Muscle Shoals plant was built by the Leonard firm in 1950-1952 to meet an anticipated chlorine shortage as a result of the Korean crisis. When the shortage failed to materialize, the plant was maintained in standby condition. Declared "surplus property" by the government late last year, it was purchased by the company in October.

**Hartford Steel Ball
Appoints Factory Manager**



Robert D. Sterling

Robert D. Sterling has been appointed factory manager of *Hartford Steel Ball Co., Inc.*, Stephen V. Zavoico, president of the company, announced recently.

Mr. Sterling comes to his new position with a background of experience in the manufacture of precision balls and ball bearings. He served for eight years with the New Departure Division of General Motors at their plants in Connecticut and Sandusky, Ohio. Most recently he was superintendent of the Precision Instrument Bearings Department of New Departure at the Meriden plant.

Mr. Sterling is a graduate of Rensselaer Polytechnic Institute. He has been a resident of Connecticut for most of the past twenty years, leaving the state for three years to be with the Carnegie-Illinois Steel Co. in Pittsburgh and for two years with New Departure in Sandusky, Ohio. He moved to West Hartford five years ago, and makes his home there now at 32 Rumford St.

Baldwin-Gregory Co. to Counsel on Hot Dip Galvanizing Problems

Announcement is made of the formation of the *Baldwin-Gregory Co.*, located at 121 Kemp Ave., Fair Haven, N. J. as consultants on hot dip galvanizing problems.

The company will specialize in the surveying of existing plants or departments and recommending of improvements. It will layout, plan and supervise the installation of new plants or rearrangement of present ones, in-

cluding assisting in securing of equipment, designing of special equipment and training of operating personnel.

The new company will bring to bear over twenty-five years of experience in the practice of theory of hot dip galvanizing in its top executives, *Allen T. Baldwin* and *William P. Gregory*. Mr. Baldwin is manager of flux sales with *Hanson-Van Winkle-Manning Co.*, at Matawan, N. J. and Mr. Gregory is vice-president of *New Jersey Galvanizing and Tinning Works, Inc.* at Newark, N. J. Both men will retain those positions in addition to functioning as executives at the Baldwin-Gregory Co.

L. V. Schowalter Joins Weaver Engineering

L. V. Schowalter has joined the organization of *Weaver Engineering & Supply Co., Inc.* 718 W. Main St., Grand Prairie, Tex. He will be chiefly responsible for the promotion of the supply items distributed by this concern in the southwestern states. Due to Mr. Schowalter's experience in heat-treating supplies to their other lines.

Mr. Schowalter, a metallurgist by trade, formerly held the position of foreman of plating and heat-treating at *Chance Vought Aircraft, Inc.* from 1949 to 1953. Previous to his employment at *Chance Vought*, he held similar responsible metallurgical and supervisory positions with *Thompson Aircraft Parts Co.*, *Johnston and Jennings, Franz Mfg. Co.*, and *Machine Products Co.*



L. V. Schowalter

Mr. Schowalter, a native of Cleveland, Ohio, is thirty-nine years of age, married and has three children.

HERE IT IS!

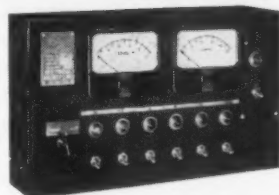


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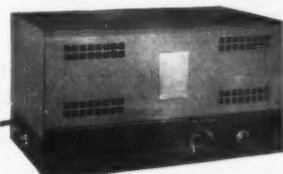
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MGFRS. OF PERIODIC REVERSE UNITS AND ELECTRONIC EQUIPMENT FOR THE PLATING INDUSTRY

Gottlieb Forms Aurochem Co.

Victor G. Gottlieb, formerly chief chemist of *A. Robinson & Son* for 10 years and later in charge of production at *Auromet Corp.* announces the formation of a new firm, *Aurochem Company*, with offices and laboratory at 125 Canal St., New York 2, N. Y.

The company will manufacture gold and other precious metal plating solutions and salts and will specialize in potassium gold cyanide, the manufacturing of which was introduced by Mr. Gottlieb at Robinson ten years ago.

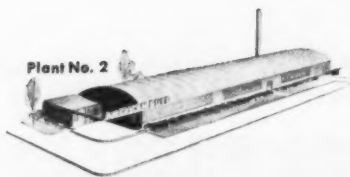
American Buff Company Now Operating Three Manufacturing Plants

Ben Sax, president of the *American*

Buff Company, Chicago, recently announced his firm now operates three separate plants, each specializing in a particular category of buff design and production.

The company's 3-plant operation consists of two Chicago sites, one manufacturing sisal buffs and the other specializing in bias buffs. A third plant located in Sandwich, Ill., concentrates on conventional buffs.

In explaining this specialized operation, Mr. Sax pointed out the arrangement permits the firm to utilize special equipment, materials and highly specialized workers in appropriate plants. The result has been increased volume of production in addition to sustaining highest product quality. He also emphasized another primary objective is



Plant No. 2



Plant No. 1



Plant No. 3

to provide opportunity and facilities for large-scale research and experimentation in continuing a search to improve buff design, fabrics and efficiency.

Cochrane Corp. Opens New York Office

Cochrane Corp., Philadelphia, Pa., manufacturers of water-conditioning equipment and steam specialties, announces the opening of its New York

district sales office at 261 Madison Ave., New York City.

Joseph R. Denton has been appointed manager of the new office. Mr. Denton is a graduate chemical engineer from Georgia Tech and has been formerly associated with Calco Chemical Division of American Cyanamid Co., and for the past fourteen years, with the Worthington Corp.

Detrex Appoints Wiggins

Platt K. Wiggins has been appointed sales representative covering western New York State for the Detrex Corp. of Detroit, announced W. F. Newbery, director of sales.

Wiggins, a native of Larchmont, N. Y., is a 1946 graduate of Cornell University where he received his A.B. degree. He is a member of the American Electroplaters' Society and Beta-Theta-Pi fraternity.

Prior to joining Detrex, Wiggins was a member of the sales staff of Proctor & Gamble for four years.

Magnuson Adds to Staff

Magnuson Products Corp. has recently designated two new representa-



Harry R. Johnson

tives. In Illinois, working out of Chicago and the surrounding counties, Harry R. Johnson will be the new representative. His background includes finishing materials as well as cleaning materials. His entire business and sales career has been in the Chicago area.

Wayne J. Streavig will operate in those counties to the west of the Philadelphia area, covering from Allentown



For better corrosion control, specify STORTS WELDING

STORTS welds all the semi-precious metals smoothly and soundly, for long, trouble-free service — gives you every dollar's worth of utility and value from these materials, and maximum effectiveness in checking corrosion.

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Liquid buffing compound
since 1945
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Cold flexible glue
since 1937
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Grain and Nuglu mixture
since 1941
- ★ **SPRAY BUFFING EQUIPMENT**
Guns, pumps, and valves
since 1945

J. J. *Siefen* CO.

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Wayne J. Streavig

to Baltimore. Mr. Streavig is experienced in the metal finishing field, having operated his own plating firm, and he has been an officer of the *American Electroplaters' Society*.

New U. S. Rubber Co. Distributor

Appointment as national distributors in the United States and Canada to the metal finishing industry for Uscolite, the new thermo-plastic type piping, fitting and valves manufactured by the *U. S. Rubber Company*, has been announced by *Guy A. Cummings*, metal finishing sales manager for *Frederic B. Stevens, Inc.*

Uscolite pipe is rigid, tough, lightweight and corrosion-resistant. It can be cut and threaded with standard equipment. It is non-toxic and chemical resistant, serving well for sensitive chemical solutions, deionized and demineralized water, plating solutions and waste treatment.

Associations and Societies

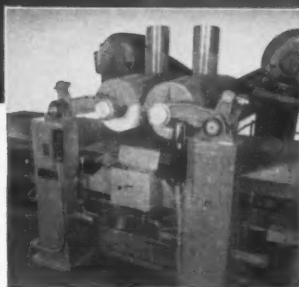
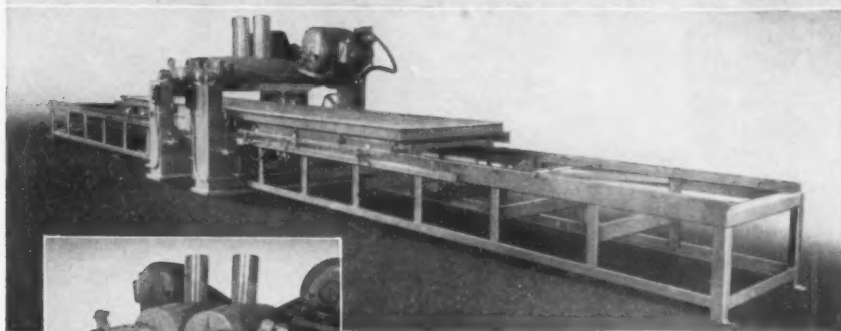
AMERICAN ELECTROPLATERS' SOCIETY

November Reports Show Plans for Convention Far Ahead of Schedule

Progress reports made by the various committees in charge of plans for the *1955 Industrial Finishing Exposition* scheduled for Cleveland, Ohio, indicate the affair will be the biggest ever.

The reports were given at a recent meeting of the Board of Directors of

Cut Time! Cut Finishing Costs! with CENTRAL Tandem Roll POLISHING MACHINES



FEATURES

1. Central Push Button Control
2. Electro-Hydraulic Contour Control
3. Tandem Rolls for faster cutting and finishing
4. Two operations at one work set-up
5. Adjustable stroke, 2" to full length capacity
6. Machines made to any length or width

Here's the solution to any polishing problem involving sheets, plates, rods, tubing, extrusions and many small items which may or may not require contour control. Tandem rolls provide for cut-down and finishing at one work set-up.

Many pieces such as electric, gas or oil range tops with side concave or convex moulding can be handled by incorporating auxiliary polishing rolls. These machines are rugged steel fabrications and powered with motors of ample capacity. They are electro-hydraulic or hydraulic controlled from a central operator's station, simple to operate, safe, effective and highly efficient.

These new Central Machines are — to the best of our knowledge the ultimate in performance, economy and low initial cost.

Firms operating these polishing machines over the past three years tell us our H-M Series Machines have paid for themselves in 8 to 12 months' time.

Full information and specifications on request. Send us samples or tell us what you want to polish.

Also made in Single Roll Horizontal Series and Double Roll Vertical Series

CENTRAL MACHINE WORKS
74 Commercial St. Worcester, Mass.

the *American Electroplaters' Society*.

The exposition is slated to run concurrently with the *42nd Annual Convention* of the society, June 20th through 23rd, at the city's Public Auditorium.

Following are some of the latest developments as reported by *Eugene L. Combs*, general convention committee chairman, in conjunction with *Leon Westbrook*, exposition committee chairman.

1. The over-all budget has already been submitted by the exposition management and approved.

2. Adequate housing has been blocked off in the city's leading hotels in anticipation of this year's exceptionally large registration.

3. Committee reports show exhibitors renewing have contracted for more space than previously taken. More than 70 per cent of the selling space in the huge auditorium has been rented.

4. Plans for technical papers are already underway, many of the authors having been selected.

In addition, a gala week of entertainment has been planned for the ladies. A fashion show; several teas; Plato Party; guided tour to the famous Westgate shopping center and a luncheon at the Lake Shore Hotel, featuring a Gay 90's program. A special luncheon and show at the Alpine Village Restaurant, one of the city's leading entertainment spots, heads the list.

The Athletic Committee reports ar-



Smiles on faces of the A.E.S. board of directors indicate satisfaction at the way plans are shaping up for the 1955 Industrial Finishing Exposition. Seated left to right around table are: Francis T. Eddy, third vice-president, A.E.S.; Samuel Heirman, Second vice-president, A.E.S.; Eugene L. Combs, general convention committee chairman; Clyde Kelly, first vice-president, A.E.S.; George Burnley, advertising manager, Plating Magazine; R. A. Schaefer, president A.E.S.; P. P. Kovatis, executive secretary, A.E.S.; G. P. Swift, past president, A.E.S.; Harold E. Bartlett, exposition manager; Albert W. Erickson, Jr., manager space sales, 1955 Industrial Finishing Exposition.

rangements made for golfing facilities at four of the city's leading golf courses for the men.

The entertainment committee reports the preparation of a special show by

name entertainers. For the opening day of the convention there will be a special East-West softball game played at Edgewater Park.

The Cleveland Auditorium is con-

sidered an ideal site for the Annual Convention and Industrial Finishing Exposition. In addition to its spaciousness and all-inclusive facilities, it is located within walking distance from the major hotels in the city.

Because all sessions of the meeting will be held under the same roof as that of the Industrial Finishing Exposition, it will be easy to visit the adjacent exhibit area in the Auditorium.

Louisville Branch

The regular monthly meeting of the Louisville Branch, was held Thursday, Sept. 16, 1954, at Kapfhammer's Party House, 1506 South Shelby St., Louisville, with a dinner served at 6:30 P.M. President *J. W. Scholl* opened the business and open meeting at 8:00 P.M. with twenty-eight members and guests present.

Technical Sessions Chairman, *S. J. Beyer*, reported that the October meeting will be a Ladies Night—Special Program Meeting. We will have *Al Aronson*, Columnist of the Louisville Times as the speaker and also a movie entitled, "A is for Atom."

President Scholl appointed by proxy *Wm. Young*, of the Cincinnati Branch,



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... determines sulfate content in a chromium plating bath ... directions are easy to follow ... no calculations necessary ... readings are directly in ounces per gallon. Write for descriptive literature.

• KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes ... special sets can be provided for your requirements. Write today for complete information — no cost or obligation.

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Specify KOCOUR test sets from your supplier.

BRIGHTER Barrel Nickel Plating with TRUE BRITE NICKEL BRIGHTENER

Increase Production

easy to control ... cuts down on trouble that entails costly delays.

Save time

can be operated at a higher speed.

Reduce Rejects

gives unbelievable uniformity of deposit in recesses ... brighter, white color.

Write for FREE bulletin revealing tricks on improving your nickel plating and cutting costs.

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P. O. Box 31, Oakville, Conn.

to represent the Louisville Branch at the October 8 meeting of the Tri State Regional Meeting. The President also appointed *J. G. Sterling* as a delegate to the Tri State Regional Meeting, which will be held at Columbus, Ohio, sometime in the Spring of 1955. *Richard G. Marshall* was appointed to the office of Sustaining Membership Chairman.

Mr. Beyer, as a delegate from the Louisville Branch to the National Convention, which was held in New York City, in July, 1954, gave a very fine report of the convention and its activities. Stanley also announced that the speakers list for the balance of the fiscal year was completed.

The meeting was turned over to Educational Chairman Beyer, who, after a brief talk, introduced *H. M. Goldman*, assistant sales manager of the Enthone Co., New Haven, Conn., as the speaker of the evening. Mr. Goldman spoke on the subject of coloring of metals.

Slides were shown and narrated by Mr. Goldman. Considerable discussion followed and he was given a rising note of thanks for a very interesting talk.

An Armed Forces Information film was presented after the talk. The meeting adjourned at 11:00 P.M.

J. G. Sterling,
Secretary-Treasurer

Detroit Branch

The October meeting of the Detroit Branch was held on Friday, October 1, 1954 at the Statler Hotel. President *Joe Gurski* called the meeting to order at 8:30 P.M. with approximately 250 members present.

In the absence of *E. A. Steeger*, Mr. Gurski turned the meeting over to *Glen Friedt, Jr.* for the installation of delegates. *Herb Head*, *Don Bigge*, and *Lee Morse* were the elected delegates.

Secretary *Bob Racine* informed the group the chapter had purchased some series J, United States Bonds. Bob also informed the branch, eleven applicants were elected to membership in the Society tonight. This brings the total membership of the Detroit Branch to 647 members.

President Gurski announced the tickets for the annual Christmas Party would be available soon. He also informed the members the announcement

had been made for *Herb Head's* candidacy for 3rd Vice-President of the Supreme Society.

The meeting was "Stump the Experts" night. The four "specialists" who came prepared to answer questions from the members were:

Manuel Ben—General Motors Research Division.

John Hitchcock—Electrochemical Dept. — DuPont.

Ed Kubis—Wyandotte Chemicals Corp.

Wright Wilson—Auto City Plating Co.

After the experts had finished, *Lee Morse* gave a short talk explaining the meaning of the *American Electroplaters' Society* to the new members.

Refreshments were served following the meeting.

Patrick J. Driscoll

Grand Rapids Branch

The October 8, 1954 meeting of the Grand Rapids Branch was a gala affair. It was Ladies' Night, when all business and electroplating know-how was absolutely forgotten. Everybody just relaxed and enjoyed a very fine

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BUFFING AND POLISHING COMPOUNDS**
for

Aluminum, Brass, Copper, Stainless Steel, Carbon Steel, etc.

CAKE, DIP AND SPRAY

CEMENT AND THINNER
for setting up wheels, belts and rolls.

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UDYLITE SERVICE DOESN'T COST—IT PAYS

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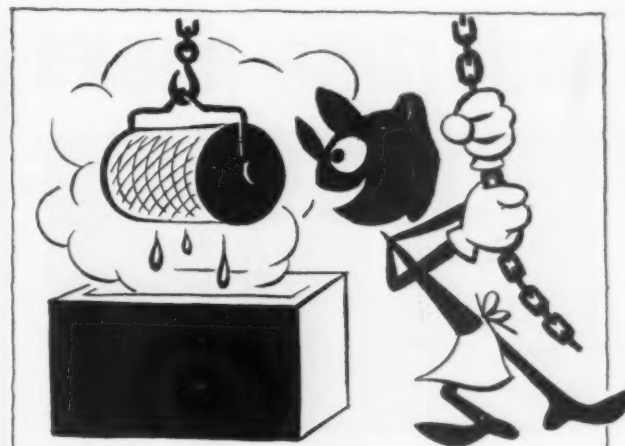
DO YOU HAVE A DIFFICULT PART TO PLATE?

Take your problems to Udylite. We have a pilot plant where we will check your plating problem and make recommendations. It will save you from future costly mistakes. This service is free! Write to—

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Pickling Pete Knows what's best Picks Monel For the acid test

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extra life
extra capacity
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Monel Pickling Equipment

social evening. The party was held at the "Yellow-Jacket," a night-spot located on M-50 about 20 miles west of Grand Rapids and 106 members and their wives attended. Soft lights and organ music accompanied the fine dinner of chicken and fish.

After the dinner, President *Carl Green* cordially welcomed the ladies, whereupon, he and *Perry Burnham* proceeded to draw names for the door prizes. There were so many gifts that nearly all the ladies won something. Some of the ladies (we presume old friends) even received a kiss from President Green.

Over 18 supply houses contributed these gifts for the happiness of the ladies. "Gorgeous Gifts for the Gals," was the theme of the evening. All the ladies were delighted with their gifts. To all the contributing supply houses which made these splendid gifts possible, we extend our sincere gratitude.

After the tables were cleared, "Doc" *Mustee*, master of ceremonies for the evening, called the group together to dance the "hokey-pokey" and then the "bunny-hop." This dance proceeded around the hall but was stopped for

fear some of the ol-Timers would have a heart attack. While the group recuperated from this later dance, "Doc" *Mustee* did a few impersonations. The one of *Jimmy Durante* at the piano was particularly good. Everyone thought we should have another party like this again next year.

Cincinnati Branch

Thirty-five members and guests were welcomed at the October 27th meeting of the Cincinnati Branch. After a fine dinner, President *Gordon* called the meeting to order at 7:30 p.m. Usual formalities were observed. *Dick Evans* gave a report on the meeting of the delegates to the 2nd Annual Tri-State Dinner Dance on October 8 at Columbus, Ohio. Everything seems to be progressing splendidly toward another successful event, to take place on March 28, 1955. *Dick's* report was made a part of these minutes.

Ezra Blount reported that the 3rd week of May had been selected for the 1958 National Convention in Cincinnati, with headquarters at the Hotel Sheraton-Gibson. This brief business meeting left the group in a

receptive mood for a fine movie on the H Bomb, "Operation Ivy."

Chas. E. Kimmel of the Dow Chemical Co. was the speaker for the evening, giving an interesting talk on "Magnesium Finishing," illustrated with slides. Mr. Kimmel outlined some of the requirements for finishing magnesium, as well as problems of assembly with this metal. He went on to point out some new treatments of magnesium, such as Dow No. 17 anodize, and HAE treatment. Plating of magnesium involves activation—zinc immersion coat—copper strike—copper plate—nickel plate—chromium. Parts were distributed showing various chemical and plating finishes.

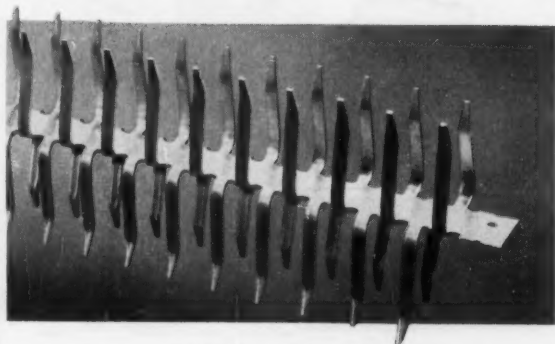
Members present were guests of The Harshaw Chemical Co. at the usual social hour.

L. J. Howald,
Secretary

Indianapolis Branch

The use of unplasticized polyvinylchloride in the plating plant was the subject of the program of the November 3rd, 1954 meeting. *Charles Kramer*, assistant sales manager of Carpart

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ALL-BRITE MODEL #200A

Manufactured of aluminum (conventional) or titanium, which is not affected chemically and lasts indefinitely.

SAVE TIME

Eliminate springs, wires, etc.

ECONOMICAL

Fast racking and unloading. Cost nominal

VARIABLE

Capable of handling most parts for volume anodizing

Technical Service and Prices Available on Request

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The Udyllite Research Corporation was founded to plan for tomorrow. We can help you with your five-year or ten-year program. It costs you nothing to find out. Write to—

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- TANKS, FLOORS, FUME DUCTS AND PROCESS EQUIPMENT
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Corp. was the speaker. Mr. Kramer compared the material with wood, rubber, resins, tile and brick, glass and plastics. On the present day market, there are ninety-four different brand names of this product. Germany is the country in which it originated and numerous installations were cited as proof of its wearing qualities.

The speaker told about different applications in the plating plant, which were liners for tanks, duct work and hoods, current blocks, nuts & bolts, pipe, fittings, valves, etc. Considerations which are important are the economics of problem and figures were given as to just what a certain size tank would cost to line. After Mr. Kramer gave the facts about the material, he demonstrated equipment to weld or heat seal the material.

Preceding the program the business meeting was held and thirty-four members and guests attended. After introductions, the secretary's and treasurer's reports were given. President, Elmer Lundberg, presented Abraham Max, the immediate past-president with his past-president's pin.

Quentin Shockley reported on the

annual meeting and stated that, for the education session, the three subjects will be electroless nickel, aluminum finishing and hard chromium.

Herb Kennedy reported on the October 8th meeting at Columbus, Ohio for planning of the regional meeting at the Deshler-Hilton Hotel on March 26, 1955. A copy of the minutes of this meeting is on file with the secretary's records.

Three new members were voted into the branch in a motion by Ed Bruck and seconded by Mr. Shockley. They were:—

John R. Rogers, R. No. 1, Box 55, Camby, Ind.

Charles A. Minor, 730 E. Washington St., Indianapolis, Ind.

James P. Supple, 3625 N. Bancroft St., Indianapolis, Ind.

A transfer was read by the membership chairman, Mr. Kennedy. This transfer is from Dallas, Tex. and the member is Othia H. Kernodle, 1619 Medford St., Indianapolis.

The meeting adjourned at 9:45 P.M.

Edna Rohrabach,
Secretary

Pittsburgh Branch

The Pittsburgh Branch held its monthly meeting at the Sheraton Hotel's Avalon Room, Wednesday evening, November 3, 1954. As is customary the meeting was preceded by dinner.

We were pleased to welcome three new members into the branch, R. H. Smith, W. D. Aust, and L. A. Zimmerman, and be hosts to 12 guests for the evening.

The speaker for the evening was Dr. Alfred Douty of American Chemical Paint Co. who talked on "Phosphate Coatings on Steel." The interest Dr. Douty's talk stimulated was attested to by the unusually large turnout of members and guests.

Dr. Douty confined his talk to the history, development and general applications of the different types of phosphate coatings. However, after a brief pause for refreshments and drawing for the door prize a long and lively discussion period on specific uses and problems encountered with phosphate coatings took place.

Herb Schram,
Secretary



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PLATING
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**A BETTER SOURCE OF DC POWER —
MORE FOR YOUR MONEY**

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Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.



**Replacement Rectifier Stacks
for Lektron or UdyLite-Mallory**

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs \$265.00.



**PRICE
\$750**

Model 4045—750 amps at 12 volts DC—1300 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

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Plating Racks you can adjust to the job



Effect BIG Saving

Thinker Boy Racks are assembled from precoated members and tips. BELKE Vac-Seal Assembly seals the joints—only contact tips are exposed to the solution. Racks are easily disassembled without damage to coating.

Available as completely assembled racks or precoated rack members and tips.

Send for literature.

When Thinker Boy Racks for a certain job are no longer needed you can respace the members or disassemble and use the parts for other racks.

No added investment. Just order Thinker Boys when you buy racks. Instead of ceilings cluttered with no longer needed racks, you'll soon have a supply of Thinker Boy Parts—be able to assemble coated racks of your own design in a matter of minutes. Ask your BELKE Service Engineer or write for details.



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EVERYTHING FOR PLATING PLANTS

Los Angeles Branch

An S.R.O. crowd of 125, including 18 local and out-of-town guests, attended the November 10th meeting of Los Angeles Branch to hear *R. J. Racine* of the Wyandotte Chemicals Corp., Wyandotte, Mich., present a talk on "The Various Phases of the Metal Cleaning Problem."

Prior to launching into his technical discussion, Mr. Racine, who is financial vice-chairman of the A.E.S. national research committee, gave a brief review of what the research committee is doing at present and what it has in mind for the near future. The committee, he reported, proposes to attempt to secure wider publicity for research projects in order that the activities will become better known to the membership at large. The national research committee, Mr. Racine revealed, has seven projects currently underway and is considering three more, including a project that would attack the cyanide waste disposal problem from a new approach, with project work centered at Michigan State College.

In his talk on metal cleaning problems, Mr. Racine devoted some time to discussing the radioactive tracer technique of evaluating the effectiveness of cleaning procedures. In his prefatory remarks he outlined the definition of cleaners and detergents, and their major functions—the removal of soil from metal. He next went into the various aspects of how it is done, forms of physical chemistry involved, various surface effects, including saponification, solvent action and mechanical action, and the materials used as activating agents.

Branch president *G. Stuart Krentel* presided over the business session, which was called to order at 8 p.m. Sergeant-at-arms *Harold Wanamaker* introduced the following guests:

Jerry Hinshaw, Sundmark Supply Co.; *B. Arden*, Turco Products Co.; *Wesley Mehlim*, North American Aviation; *John McInnes*, New England Lead Co.; *Norman Pohlen*, Alladdin Metal Finishing Co.; *Mitchell Raskin*, Ajax Plating Co.; *James Routen*, Atlas Plating Co.; *Norman Garvey*, U. S. Spring & Bumper Co.; *Joe H. LeVoy*, Peterson Plating and Process-

ing Co.; *Jerry Burton*, Burton Plating Co.; *B. C. Guise*, California Testing Laboratories; and the following from Wyandotte Chemicals Co.: *Fred Vassar*, *James Beasley*, *Thomas Todd*, *Robert C. Gertson* and *James Braine*.

New members: *Joe LaVoy*, *Al Castellarode* and *Robert Potter* were inducted. Applications were received for December Processing from *William Robinson*, *E. Willes*, *Richard Erickson*, *Norman Suntner*, *John Manning* and *Lester Daniels*.

President Krentel appointed a nominating committee and delegated it with authority to recommend a slate of 1955 officers for election at the February, 1955, meeting. Composing the committee are past-presidents *Don Bedwell*, *Earl Coffin* and *Walter Behlendorf*. It was moved that the standard procedure for election be followed and that members be allowed to designate their choices for officers by letter to the nomination committee.

The general arrangements committee for the branch's 1955 Annual Education session, headed by *George Heyz*, met with President Krentel before the opening of the general meet-

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Industry's Abrasive
BONDING CEMENT
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• How does it do this? Because GRIPMASTER grips the abrasive grain more firmly than conventional cements, thus maintaining a more uniform abrading head. Coupled with this Better Production is an Economy you can't afford to overlook—namely, increase in polishing wheel or belt life because less heading up and preparation for heading up are required. A working test sample will convince you. You can order this sample in 75 pound pails or in a package of 4 one gallon cans. Many, after proving its value under their own working conditions, order GRIPMASTER in the usual 660 pound drum lots.

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ing to discuss speaker possibilities for that event.

San Francisco Branch

Arthur Logozzo of the Nutmeg Chrome Co., Hartford, Conn., a past-president of the A.E.S., addressed the October meeting of San Francisco Branch on chromium plating, which was amplified by an outstanding film on tin and chromium production.

The film presented the many ways for racking parts, using small to large inside anodes, and the various methods for producing bright to brilliant precision chromium plate. The importance of good masking and ripple content of the DC power in order to obtain good chrome plate was stressed. After the film and slides were presented, a question and answer period was conducted.

President Edward Kettman presided over the business session at which J. R. Pattenger was named chairman for the Christmas Party to be sponsored by San Francisco Branch in mid-December.

New members elected were Fred Herman and Andrew S. Pugliarissi

of Redwood City; Fred Jensen, Palo Alto; M. E. Hagendiffer, Valejo; Justin B. Call, Menlo Park; and Arthur E. Schwartz, Hayward.

AMERICAN SOCIETY FOR METALS

Dr. Joseph F. Libsch, professor of metallurgy at Lehigh University, has received the \$2,000 award from the American Society for Metals for outstanding contributions to the teaching of metallurgy. The prize, awarded annually to young teachers of metallurgy, was presented to him at the 36th metallurgy congress and exposition in Chicago early last month.

A native of Rockville, Conn., Dr. Libsch has been a member of the Lehigh faculty since January 1946. He is a graduate of the Massachusetts Institute of Technology. During World War II, he served as a captain in the Army Ordnance Department, assigned to the Springfield Armory for metallurgical research and development.

Porcelain Enamel Institute

The Porcelain Enamel Institute calendar for 1955 will again be high-

lighted with four principal meetings, three of which are annual events.

A Pacific Coast Conference will be held on March 10, 11, 1955 at the Biltmore Hotel in Los Angeles, Cal.

The Mid-Year Division Conference will be held on May 18, 19, 20, 1955, at the Edgewater Beach Hotel in Chicago, Ill.

The 17th Annual Shop Practice Forum is scheduled for September 14, 15, 16, 1955 at the Deshler-Hilton Hotel and The Ohio State University in Columbus, O.

The Institute's 24th Annual Meeting will be held October 26-28, 1955. The meeting place will be The Greenbrier, White Sulphur Springs, W. Va.

The Institute just recently held its 23rd Annual Meeting at The Greenbrier, and elected Glenn A. Hutt, Ferro Corp., as president for the next 2 years.

THE ELECTROCHEMICAL SOCIETY, INC.

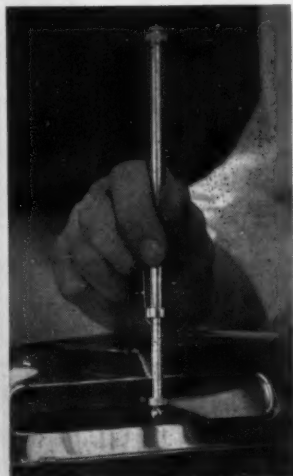
The Acheson Medal and Award was presented to George W. Heise by The Electrochemical Society at its 106th Convention in Boston on October 5 in recognition of his outstanding techni-

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Tests thicknesses from 0.0001 to 0.015 inch. Each individual gage is separately calibrated to National Bureau of Standards thickness plates, resulting in an accuracy to 10% for thicknesses over 0.0002 inch. As simple to use as an automobile tire gage, the Pocket Handi-Gage may be used on the production line or in the lab. It's perfect as a "Go, No-Go" thickness gage at the plating tank or spray booth.



NO BIGGER THAN A FOUNTAIN PEN, BUT WHAT A JOB IT DOES!

Tests brass, cadmium, copper, lead, nickel, silver, tin, zinc, lead-tin and zinc-tin alloys, hot dipped tin and zinc, paint, plastic laminations, enamel and lacquer on steel and other magnetic metals. Gives results in SECONDS. Especially adapted for hard-to-reach areas. Comes in a pocket-sized case complete with magnets for various thickness ranges.



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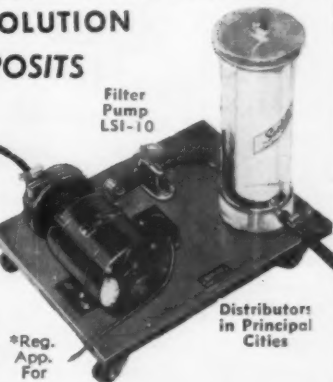
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SERVICE: Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.

DESIGN: Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubberlined.

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Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb.
LSI-10	100 "	12" x 16" x 16"	40 "
ASI-300	300 "	2' x 2' x 2'	125 "
ASI-400	400 "	2' x 2' x 2'	135 "
ASI-600	600 "	2' x 2' x 2'	150 "



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cal achievements and his many contributions to the welfare and growth of the Society. The Acheson Award, consisting of a gold medal and a cash prize of \$1,000.00, was established in 1929 and has become the Society's highest honor. Mr. Heise is the 13th recipient.

Associate Director of the Research Laboratories of the National Carbon Co. in Cleveland, Ohio, at the time of his retirement last year, Mr. Heise is one of the world's leading authorities on primary batteries and for many years has written on this subject for the Encyclopedia Britannica. At present he is serving as chairman of advisory Battery Panels for both the Office of Naval Research and the National Research Council.

November 17th Meeting

The Metropolitan Section held its meeting of November 17 at Schwartz Restaurant, 54 Broad St., New York City, preceded by cocktails and dinner. After a short business meeting Martin Quaelly, chairman, introduced the speaker of the evening, Dr. Seymour Senderoff of the Electrodeposition Section, National Bureau of Standards, whose topic was "Electro-

chemistry of Refractory Metals." After referring to the fact that, aside from chromium which can be deposited from aqueous solutions, the other refractory metals, molybdenum, tungsten, titanium and zirconium require the use of fused baths, Dr. Senderoff discussed the attempts made with various baths, the results obtained and possible mechanisms to account for the results.

Although the greater part of the talk was on the deposition of molybdenum, which has been most successful to date, the similarity of the problems involved with tungsten, titanium and zirconium was demonstrated, as were the points of difference.

Lively discussion followed the talk and numerous questions were directed at Dr. Senderoff by members of the exceptionally large audience.

Manufacturers' Literature

Plating Racks and Tips

Belke Mfg. Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

A new 12-page illustrated catalog describes insulated plating rack sec-

tions and insulated contact tips. It shows how many different rack styles can be assembled from a small assortment of insulated rack sections—how removable contact tips are joined to rack frame with leakproof seal—how insulated contact tips can be adjusted or reformed to rack all kinds of articles.

Bright Copper Process

The Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

Just published is a new technical manual on the Lea Copper-Glo process for bright copper plating. Copies are available on request from the above company.

Precious Metals

Technic, Inc., Dept. MF, Providence 1, R. I.

Soluble precious metals available for electroplating are listed, along with a statement on precious metal electroplating with scientific accuracy, in a new price card.

Previously, the growing importance of precious metal electroplating throughout industry has induced the

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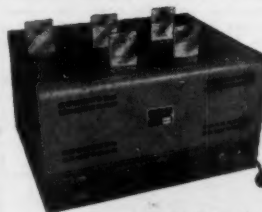
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manufacturer to publish technical data, much of it original, on gold and rhodium solutions for electroplating. The new price list complements this material with specific data and prices which will enable engineers and purchasing agents to compute manufacturing costs.

The new price list is in the form of a card folded to convenient pocket size, imprinted on heavy stock to permit constant reference.

Chromate Conversion Coatings

Allied Research Products, Inc., Dept. MF, 404 E. Monument St., Baltimore 5, Md.

The above company has just issued a comprehensive file of technical literature on Iridite chromate conversion coatings for prevention of corrosion and paint-base treatment of non-ferrous metals. The brochure consists of a handy standard-size file folder with eight dividers classifying data by (1) general information, (2) metal to be treated and (3) finishing processes.

In addition to the basic file, detailed "Technical Information" sheets for insertion in these sections offer general technical and government specification

data of value to finishers, and specific operating instructions for individual processes.

Centrifugal Pumps

Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 Ogden Ave., Chicago 50, Ill.

A new eight-page bulletin on their line of vulcanized-rubber-lined centrifugal pumps and stainless steel and cast steel centrifugal pumps has been issued by the above company. Besides giving detail specifications and describing the design and construction features which, the company claims, offer superior performance, this bulletin includes performance curves for the various models.

Finishing Specialties

Jelco Products Corp., Dept. MF, 153 E. 25th St., New York 10, N. Y.

A new bulletin has been completed which lists the firm's entire line of metal finishing and plating equipment and specialties for easy reference. On the back page is a selection of data which come into everyday use in a plating shop. These data are not usu-

ally available in most literature. For example, one of the tables lists the amount of alkali cyanide needed to dissolve various salts in making up a cyanide bath.

Corrosive Gas & Air Filter

Mechanical Industries, Inc. Dept. MF, 910 Grogan Bldg., Pittsburgh 22, Pa.

The Dorfan Impingo Filter for cleaning hot, wet and corrosive gases and air has been detailed in a new 8-page brochure, Bulletin No. 4. The filter removes dust, dirt and impurities by passing gases horizontally through two or more cells containing moving granules. Included in the brochure are a variety of installation photographs, engineering drawings of filter components and complete systems, as well as descriptive data.

Capacitive Level Indicator

Thermo Instruments Co., Dept. MF, 1310 Old County Road, Belmont, Calif.

A meter-indicating level monitor deriving its signal from an inert capacitive-type sensing probe is described in a new leaflet Form LI-2. The new Bel-

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TIN-ZINC PLATED



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STOCK ITEMS for QUICK SHIPMENT

Made of welded, water-tight construction. Quickly attached with four bolts for which holes are drilled. All barrels can be furnished with vinyl plastic lining, if desired.

4 SIZES AS FOLLOWS —

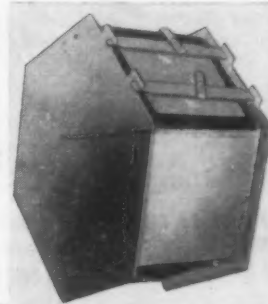
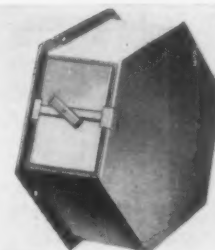
- 5-gallon open conical, hexagonal Tumbling Barrel.
- 5-gallon closed hexagonal Burring Barrel — 17" dia.
- 1.1 cu. ft. (8 gallon) closed Hexagonal Burring Barrel — 17" dia.
- 2 cu. ft. closed Hexagonal Burring Barrel — 23" dia.

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mont panel-mounting instrument and its remote probe are illustrated and recommended for application with most non-adhesive chemicals, and all condensed gases over a temperature range from 500 to -425 F. Specifications show that the instrument can be operated from high vacuum to pressure as high as 100,000 psi. Data are included illustrating uses of the unit in remote indicating applications where the repeat meter can be located at a practically unlimited distance from the main sensing installation.

Measuring and Control Equipment

Simplex Valve & Meter Co., Dept. MF, 68th and Upland Sts., Philadelphia 42, Pa.

To illustrate various types of control and measuring equipment, a 4-page flyer Bulletin 050, has been prepared with general information on both primary and secondary measuring devices.

Included are short descriptions and characteristics of standard and elliptical venturi tubes as well as parabolic flumes used as primary devices to actuate secondary indicating, recording and totalizing units. Of interest are

illustrations of miscellaneous types of air release and air inlet (vacuum breaking) valves and the new controlled closing valve, Type CCAV.

Blackening Steel

Eltex Chemical Corp., Dept. MF, 41-45 Seekonk St., Providence 6, R. I.

Advantages of the Jetal Process for protecting and decorating irons and steels with a black oxide finish are fully detailed in a new folder. The process, according to the new folder, increases the wear resistance and toughness of ferrous metals. The finish becomes part of the metal as a deep black coating of high protective value, without affecting dimensions or surface texture.

Temperature Controls

Burling Instrument Co., Dept. MF, 16 River Road, Chatham, N. J.

Bulletin 104 covers the Model D-1S, primarily used for controlling temperatures up to 1,800°F., where a wide and easily adjustable range is required.

The instrument described operates by the differential expansion of solids

and uses no filled bulb. A snap-action switch, rated at 15 amp., 125-250 volts, 60 cycles, is actuated by the tube expansion through a lever.

Industrial Instruments

The Bristol Co., Dept. MF, Waterbury 20, Conn.

A new general bulletin, DM035, listing and illustrating the complete line of recording automatic controlling, and telemetering instruments manufactured by the company has just been published. The bulletin features the new line of Metagraphic pneumatic transmission instruments, which divide the functions of measuring, recording, and controlling into three separate instruments to achieve maximum flexibility in application. The Metagraphic receivers also have the feature of quick interchangeability of recorders and indicators. The changeover is accomplished without loss of signal pressure or control.

In addition, the bulletin illustrates and describes briefly the full line of recorders and controllers for temperature, flow, liquid level, mechanical motion, running time, count, and opera-

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tion, and speed. Also included are electric and electronic instruments for measuring current, voltage, power, and other variables which can be translated into electrical quantities, such as strain, capacitance, resistance, and smoke density.

Impervious Graphite Centrifugal Pumps

Falls Industries, Inc., 31781 Aurora Road, Dept. MF, Solon, O.

A new Bulletin, No. 854, covers all six standard models of Impervite impervious graphite centrifugal pumps ranging in size from 25 to 2,000 g.p.m. at 20 to 100 ft. head. These pumps now incorporate a virtually leakproof seal, fabricated from two high-density carbon rings. It features a simple, self-cooled rotary section, and is easily accessible. A break-away drawing, and complete information on the seal is contained in the new catalog.

The catalog also includes detailed parts drawings, accurate dimensional drawings, and performance charts for each model. In addition, chemical and physical properties of impervious graphite are listed.

OBITUARY

L. JOSEPH MOYES



L. Joseph Moyes, Hanson-Van Winkle-Munning Co. sales representative in the states of Wisconsin and Minnesota, died at the Milwaukee Hospital on October 25, after a long illness. He was 37.

Prior to joining H-VW-M in 1952, he was with the Diversey Corp., and worked for many years in the metal finishing field. A resident of Milwaukee since 1941, Mr. Moyes was a member of the American Electroplaters' Society and the Milwaukee Athletic Club.

Surviving are his wife, Betty; a son, Michael; a daughter, Kathleen; three sisters and a brother.

NEW BOOKS

Chromium Plating

By P. Morisset, J. W. Oswald, C. R. Draper and R. Pinner. Published by Robert Draper Ltd., 83 Udney Park Road, Teddington, Middx, England. 1954. Price: \$11.00 postpaid. 584 pages including index.

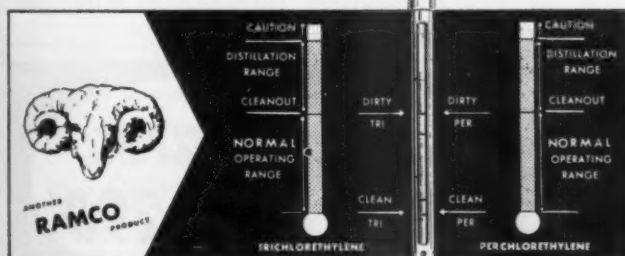
Between them, the four authors have compiled the most comprehensive collection of data on the subject of chromium plating together with its ancillary processes which has ever appeared

New! RAMCO

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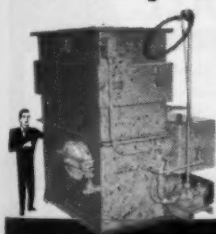
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This kit offers a new simplified method for rapid checking of zinc, cadmium, copper, brass and nickel solutions; acids and cleaners.

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in print. The 425 references in the bibliography will bring the researcher up to December 1953, an extraordinary accomplishment in a book published less than 6 months later.

Every phase of the subject is covered in detail and the treatment of racks and auxiliary anodes alone would warrant investment in the purchase price. Of course, a large part of the contents comprises a review of the literature rather than the results of investigations by the authors. This leads to a lack of discrimination, such as is evidenced in contradictory statements about throwing power of chromium solutions. On page 27 it is stated that concentrated baths have a slightly better throwing power, while on page 49 it is stated that the throwing power decreases with increase in chromic acid, and still a few paragraphs later, that the best throwing power was obtained with 40 oz./gal. chromic acid which would be considered a medium concentration. Again, on page 49 the throwing power is stated to rise with increase in sulfate while, on the next page, another reference claims that high chromic acid: sulfate ratios favor throwing power. The practical plater, who might be interested in learning under what conditions to plate for best throwing power, would find himself in trouble here.

Such deficiencies, on the whole, are rather minor when weighed against the overall excellence of the volume. In compiling what could be considered not only a textbook but a survey and a handbook on hard and ornamental

chromium plating, the authors can be complimented on a magnificent achievement which is outstanding in the field of electrodeposition. The book belongs in every metal finisher's library because the answer to practically every possible question on the subject will probably be found therein.

Blast Cleaning

Published by Society of Automotive Engineers, 29 West 39th St., New York 18, N. Y. 1954. Price : \$2 to SAE members; \$4 to non-members. Paper cover. 54 pages.

This new manual, recently approved by the Society's Technical Board, is to be a companion to the manual on Shot Peening published several years ago. Compiled by a group of experts in the field, data are included on various types of abrasive blasting equipment and abrasives, both metallic and non-metallic. An extensive section on shot and grit specifications would be of interest mainly to large users. The manual contains much practical information on the subject and would be valuable to engineers and shop personnel although more data on small units would have been very desirable.

Procedures for Analyzing Metal-Finishing Wastes

Published by Ohio River Valley Water Sanitation Commission, 414 Walnut St., Cincinnati 2, Ohio. 1954. Price: \$1.00. 108 pages.

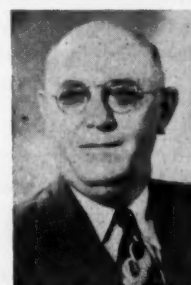
The procedures outlined in this manual, published by the Commission in cooperation with its Metal-Finishing

Industry Action Committee, represent an endeavor to provide methods that will screen-out substances which cause interference in the use of commonly accepted analytical techniques.

The report details nineteen methods recommended by the Metal-Finishing Industry Action Committee of the Commission following three years of intensive field-testing of procedures developed at Lehigh University where the *American Electroplaters' Society* has been sponsoring related projects on analytical work. The field-testing was carried out by member companies of the metal-finishing and other industry committees of the Commission as well as by the eight state regulatory agencies represented on the Commission.

News from California

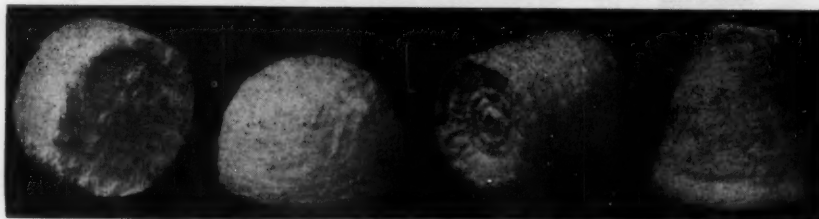
By Fred A. Herr



Crown Chemical & Engineering Co., Los Angeles, has completed installation of plating and anodizing facilities and auxiliary equipment in a new shop recently established in Culver City, Calif., by A. L. Speser under the name of Speser Plating Co., Inc.

The enterprise represents Speser's return to active operation in the Southern California finishing indus-

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GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

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try after more than a year during which he was hospitalized for five months due to a spinal fusion. A year ago Speser wasn't expected to live. Today he is back in harness as head of a new 4,000 square foot shop at 3713 S. Robertson Blvd., in Culver City, a Los Angeles suburb. Installed were facilities for color anodizing and cadmium plating. The equipment includes one anodizing tank with 1,500 ampere rectifier; one cadmium tank with 1,100 ampere rectifier; and one plating barrel. While he is equipped to do general job shop work, Speser's major volume deals with aircraft parts, with specialization in color anodizing and plating to government specifications.

Norman Garvey has been appointed manager of the Bumper Division of U. S. Spring & Bumper Co., Los Angeles, a subsidiary of Rheem Manufacturing Co., in charge of all phases of forming, fabrication and finishing of automobile bumpers. Formerly vice-president and manager of Industrial Stamping & Mfg. Co., Detroit, Mich., Garvey was brought to the

West Coast as a consultant for Rheem. Following the recent taking over of U. S. Spring & Bumper Co. by Rheem, he was named to the Bumper Division managerial position.

Arthur M. Tine, president of Mido Products, 1800 Border Ave., Torrance, Calif., manufacturers of plating chemicals and compounds, announces the appointment of Herman Ey as sales engineer in the Southern California area. Ey formerly served in a similar capacity for Sundmark Supply Co., Los Angeles, and previously was regional manager for Kelite Products, Inc., in the New York area.

Prominent mid-west visitors to the West Coast in November included the following:

H. T. McCracken, president, Northwest Chemical Co., Detroit, Mich., who spent a week in Southern California in conferences with his west coast representatives, Alert Supply Co., of Los Angeles, and visits to various plating firms.

R. J. Racine, Wyandotte Chemicals Corp., Wyandotte, Mich., who com-

bined a business trip with visits to A.E.S. branches in his capacity as financial vice-chairman of the A.E.S. national research committee.

Max Willemin has been appointed Western sales manager of Electrofilm, Inc., North Hollywood, Calif., manufacturers of solid film lubricants and film-type heating elements. He has been with the firm in various capacities since 1949.

Assembly line mass production in the field of re-gritting abrasive belts has been achieved by a new Southern California firm in the short span of four months.

The company is Diamilite Abrasives, Inc., of Santa Monica, Calif. It was organized in August, 1954, to salvage worn out sanding belts by a new process of regritting them. The process was developed by Commander John Ross, U.S.N.R., who now heads the firm as president. Fred D. Kimball is general manager and Stephen Sandberg sales manager.

In developing his process, Commander Ross sought a method for sav-

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ing industry the thousands of dollars which are wasted when belts must be discarded after the grit surface has worn to the fabric. The Ross formula, which he developed, now makes it possible to apply an abrasive which leaves a coat less than one-thousandth of an inch thick. The company officials reported to METAL FINISHING that tests have been made with hard steel, glass, wood, plastics, brass,

aluminum, stainless steel and many other substances used on sanding belts.

Through technical processes and machines specially developed for the purpose by Commander Ross, the company now rejuvenates belts which reportedly retain their original flexibility and life. Heat treating and aging bakes the abrasive and a new grit so that it will undergo tests which would destroy a newly purchased abrasive belt, the company reports.

General manager Kimball announced that the firm in November already had outgrown its original 3,000 square foot plant at 2301 Main St., Santa Monica, and that plans were underway either to enlarge the present facilities or acquire a larger plant building.

Mitchell "Mike" Raskin, plating consultant and instructor of an electroplating course sponsored by the Extension Division, University of California, in Los Angeles, made a 17 day trip in October to the Middle-West and East. He visited various plants and laboratories to find out what's new in die casting, cleaning and finishing. Plants visited included the Lee Silver Service and United Platers, Detroit, Mich.; Pontiac Motor Car Co., Pontiac, Mich.; National Lock Co., Rockford, Ill.; Sunbeam Co., Chicago, Ill., and Roto-Brosher Co., New York.

John Millhorn of Millhorn Supply

Co., Los Angeles, plating supply distributors, announces his firm has taken on west coast representation for Better Finishes & Coatings, Inc., of Newark, N. J., manufacturers of chromic acid, sodium and potassium bi-chromate, and other plating chemicals.

Rex D. Brookhart has been appointed sales manager of plastic tooling materials for Furane Plastics, Inc., manufacturers of furane resins and coating applications for concrete tanks. Brookhart was formerly in charge of plastics, sales and tool development for Wal-Mar Plastics, Inc., of Los Angeles.

American Potash & Chemical Co., recently completed a new \$150,000 control laboratory at its main plant in Trona, Calif., in the Mojave Desert, 300 miles northeast of Los Angeles.

PATENTS

(Continued from page 77)

Bright Dip for Nickel

U. S. Patent 2,680,678. June 8, 1954.
L. P. Fox, assignor to Radio Corp. of America

A method of chemically polishing a nickel surface comprising treating said surface, in cleaned condition, at room temperature with a solution consisting of 60-70% by volume glacial acetic acid, 40-30% by volume concentrated nitric acid, and about 0.5 cc. concentrated hydrochloric acid per 100 cc. of solution.

Silvering Plastics

U. S. Patent 2,680,695. June 8, 1954.
J. S. Judd, assignor to Lyon, Inc.

In a process of making a flexible mirror on a flexible plastic resin sheet, the steps of first soaking a transparent water-absorptive plastic sheet in distilled water until the sheet absorbs some water on its surface, cleaning the sheet by scrubbing the same with a potassium hydroxide solution, then rinsing the sheet successively in distilled water and a tin chloride solution, then laying the sheet out in substantially flat form, pouring a silvering solution on a portion of the sheet to be silvered to effect precipitation of a metallic silver deposit thereon, pouring off excess solution after the deposit has formed, rinsing the silvered sheet with distilled water, depositing a second

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coat of metallic silver on the previous deposit by again pouring a silvering solution on the previous deposit on the sheet to effect precipitation of a second metallic silver deposit thereon and again rinsing with distilled water, drying the silver coated sheet and then spraying over the silver deposit and beyond the margin of the deposit onto the plastic sheet a coating of flexible butadiene-styrene copolymer lacquer to protect the silver deposit and to seal over and beyond the edges of the same onto plastic sheet.

Immersion Copper Bath

U. S. Patent 2,680,711. June 8, 1954.
G. Norwitz.

A process for the immersion deposition of copper on a metal from the group consisting of aluminum and aluminum alloys which comprises immersing the metal on which the copper is to be deposited in an acidic aqueous solution of a copper salt containing a colloid of the group consisting of gelatin, agar agar, gum arabic, glue, casein, dextrose and dextrin in proportions within the range of $1\frac{1}{2}\%$ to $11\frac{1}{2}\%$ by weight of the solution, the metal on which the copper is to be deposited being electrically connected with a piece of iron, also in contact with the copper salt solution.

Continuous Wire Plating

U. S. Patent 2,680,710. June 8, 1954.
H. Kenmore and W. J. Manson, assignors to Kenmore Metal Corp.

In the method of plating wire having a cross sectional area at least equivalent to that of a round wire of 75 mils diameter to continuously produce a plated wire which is capable of being drawn after plating without rupturing or removing the plate, the steps comprising providing a wire having a large cross sectional area equivalent to at least that of a round wire of 75 mils diameter with a work hardened surface sufficient to cause the wire to retain the linear shape which is forcefully imparted thereto, applying a propelling force to said wire to move a strand of the wire axially in a straight direction, subjecting the propelled strand of wire to a plurality of linearly arranged opposed forces perpendicular to the axis of said wire to straighten the same, immediately thereafter curving the propelled strand of wire in a direction but inclined slightly from the true

vertical so as to form the wire into a helix of uniform size and pitch, the energy for straightening and curving said strand of wire being applied by said propelling force, continuously supporting and applying a rotating force to a large number of adjacent coils of said helix as they are formed so as to feed said helix along a helical path having a horizontal axis, synchronizing the said rotating force applied to said coils of said helix with said propelling force so as to prevent the development of frictional forces between the helix and the means through which said rotating force is applied to said helix, treating the suspended portions of said supported coils with a continuous series of liquid treating baths including a cleaning bath and an electroplating bath, the said propelling and rotating forces having such a speed that no substantial oxidation of the wire takes place from the time the wire of the helix enters the cleaning bath until it leaves the electroplating bath.

Rotary Brushing Machine

U. S. Patent 2,682,065. June 29, 1954.
B. E. Nelson and R. O. Peterson, assignors to The Osborn Manufacturing Co.

In combination, brushing mechanism including a rotary brush and drive means therefor, work-piece holding means operative intermittently to present a work-piece to such brush,

control means for said drive means operative to reverse the direction of rotation of such brush, and means operative in timed relation to movement of said work-piece holding means toward and away from such brush to actuate said control means thus to reverse the direction of rotation of such brush when such brush is out of engagement with a work-piece.

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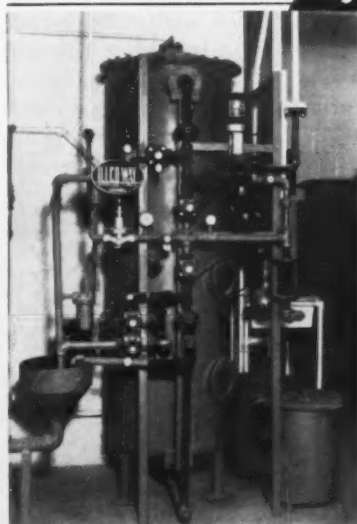
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First Polishing Show Introduces 72 Machines to 2,500 Production Managers



Shown above is a group of Behr-Manning representatives. Left to right: D. J. Olton, Mgr., Products Engineering; J. J. Durnan, National Products Engineer; A. W. Bell, Midwest Regional Manager; R. C. Ness, Midwest Divisional Manager, Industrial Trades; L. H. Vorce, Midwest Regional Products Engineering Manager.

A PREVIEW of tomorrow's polishing departments in automobile and appliance manufacturing — and the latest in production grinding and finishing machinery for the metal-working industry — was witnessed by more than 2,500 mid-western production executives at the new Behr-Manning headquarters and warehouse in Chicago on Tuesday through Friday, November 16 to 19, where some 72 new machine tools using modern coated abrasive belts were shown by 38 manufacturers at a first national Polishing Show and Conference. Arthur W. Bell of Behr Manning Co. managed the show.

Of significance equal to the new equipment gathered together and unveiled at the Show, was the assembly in one place for the first time, of the 50 technical specialists from those machinery and coated abrasive manufacturing firms who have brought into being the modern technology of production grinding and polishing with abrasive belts.

Notable new approaches to machine tool versatility with the coated abrasive belt included the biggest micro-finisher yet built (30 inches wide) for tandem prepolishing of steel strip be-

fore forming rather than after and a twin-belt surfacer which will do both sides of flat workpieces at once in continuous line production.

Ingenuity in small tools for precision grinding and polishing has begotten several idler-and-extension attachments for adapting existing grinding spindles to contact-wheel and belt usage—for contouring jobs, longer abrasive life, and the ability to use the new grits, grades, widths and backings now available in belts. One new small unit runs twin belts off a single motor for deburring and blending. Another uses the yoke principle of contact wheel support to permit exceptionally

small contact wheels (down to one inch) and reach through small openings and corings.

In backstand idlers there was shown a unit with a 6-inch macerated plastic pulley adjustable for tension and tracking from the operator's normal working position, and employing a double-lever arc method of adjustment for tracking which doesn't strain the belt.

Surely the widest variety of contact wheels ever shown — of more different designs, materials and special groovings—was a feature of high interest. One wheel featured a plastic expendable hub to circumvent tire-changing or the discard of costly hub constructions after protracted wheel use.

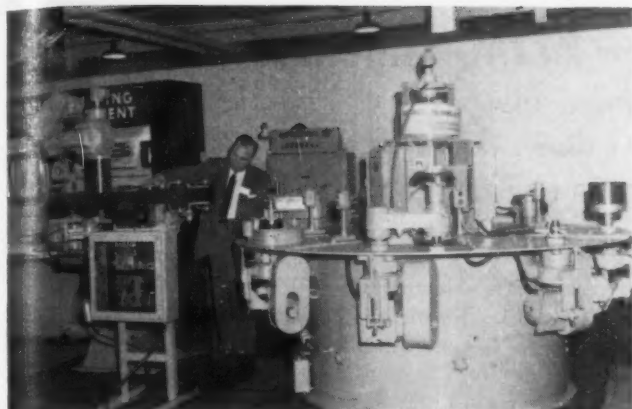
Several of the new pieces of equipment featured the platen method of achieving belt-work contact, in both horizontal and vertical orientations. Platen pressure reduces "dubbing" at the edges of sharp-edged work.

Much equipment has clearly been designed for automated production. Rotary tables with many stations for presenting work in sequence to a series of belt heads were shown by three manufacturers. A complexly articulated belt head which can follow compound curves along the length of a most intricately curved bumper without change in belt-to-work pressure stumped the mechanical ingenuity of many viewers.

Roll polishers, air tools, dust collectors, new abrasive wheels with the coated materials arranged radially rather than circumferentially, pneumatically operated backstands, automatic feeding tables for addressing a whole series of parts sequentially to vertical belt surfacers, and conveyor feeding and magnetic-chuck feeding units, were also displayed.

The belt polisher and grinder exhibited by the Curtis Machine Company, Jamestown, New York.





A portion of the Acme, Detroit, Michigan, booth showing a rotary automatic polisher and a belt polishing machine.



Backstand idler and roll polisher exhibited by Ryman Engineering Company, Elwood City, Pennsylvania.

The actual parts, products, material samples and blueprints brought into the hall for study; covered, in addition to stainless and aluminum alloys, almost every conceivable material from titanium, low and high alloy steels, cast iron, sintered carbides and die casting alloys, to glass, plastics, carbon and the copper alloys. Problems in the reclamation of reject parts by removing organic coatings were posed occasionally.

Forms ranging from hand tool, appliance, machine, toy, sports equipment, electric motor and engine parts, to weldments, tubing, sheet, die castings, stampings and metal components of every description, were tried upon the full assortment of coated abrasive machinery.

It was significant how many problems were solved by some of the new lower-cost types of coated-abrasive-using machinery, such as the yoke sander, the self-contained "space-saver," and the humble backstand idler which provides full freedom of belt and contact wheel usage with the standard polishing jack.

The basics of (1) belt tracking, (2)

belt surface speed for different classes of work and (3) contact wheel selection to match part, handling method, finish desired and stock removal rate, were threshed out with polishers whose experience with belts had been limited to but a few parts, materials and manufacturing environments.

Perhaps the greatest ingenuity exercised during the clinic had to do with both the selection and shaping of contact wheels. Coated abrasive belts running over highly contoured wheels to reach into recessed and mate with both concave and convex workpiece surfaces surprised many polishers whose experience to date seemed only to have been with flat-faced buffs and wheels. Equally surprising to many was the variety of work which can be done (as in weld removal or blending) on free-running belt lengths without rear support (the technique known as "strapping").

Notable was the number of cast iron parts which proved adaptable to finishing with coated abrasives — an area of finishing viewed difficult for belt methods up to the present time.

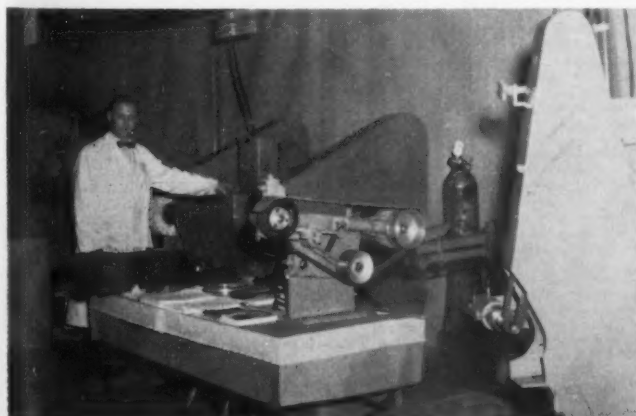
And the techniques of pre-polishing

sheet before forming, so universal already in automotive production, were tested by many in connection with utensil and appliance manufacturing.

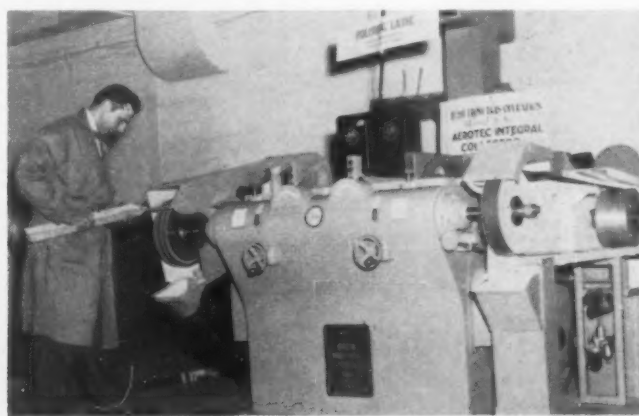
Although most of the testing on the floor of the show was done by off-hand methods, it was surprising to see the number of jobs which were being considered in terms of full-production automatic, conveyORIZED equipment. The four or five automatic machines on display received a thorough workout.

In two unusual instances laminated phenolic parts and polyester sheets were being finished for the reverse of the usual objective — to roughen the surface for paint adhesion.

Polishing department heads whose problems were analyzed at the show report that in several cases where exactly appropriate machinery for the ideal process does not yet exist, standard heads, wheels and belts will be assembled by them into special equipment. An interesting case had to do with the acceptance of the yoke-sander principle for polishing large stainless panels but requiring equipment of a much larger size not yet manufactured.



The belt polishing machine in the booth of Grinding and Polishing Machinery Company, Indianapolis, Indiana.



Large polishing lathe shown in operation by Divine Brothers, Utica, New York.

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200
1587

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JANUARY-DECEMBER, 1954

(Compiled by N. Hall, Editor, and I. Oquendo, Edit. Ass't.)

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(R)—Recent Development

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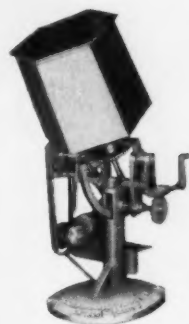
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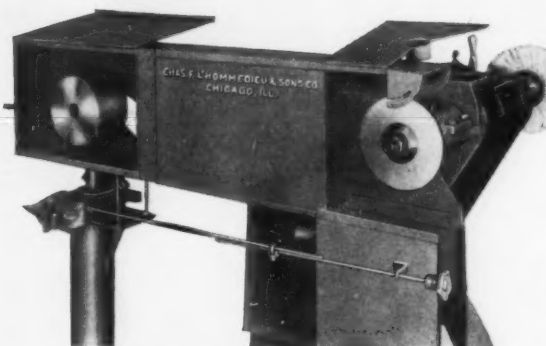
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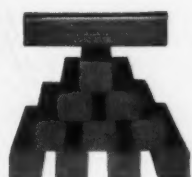
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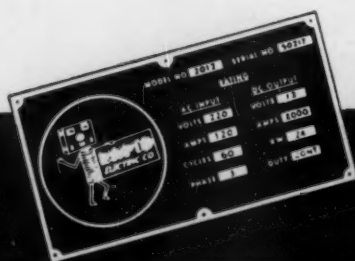
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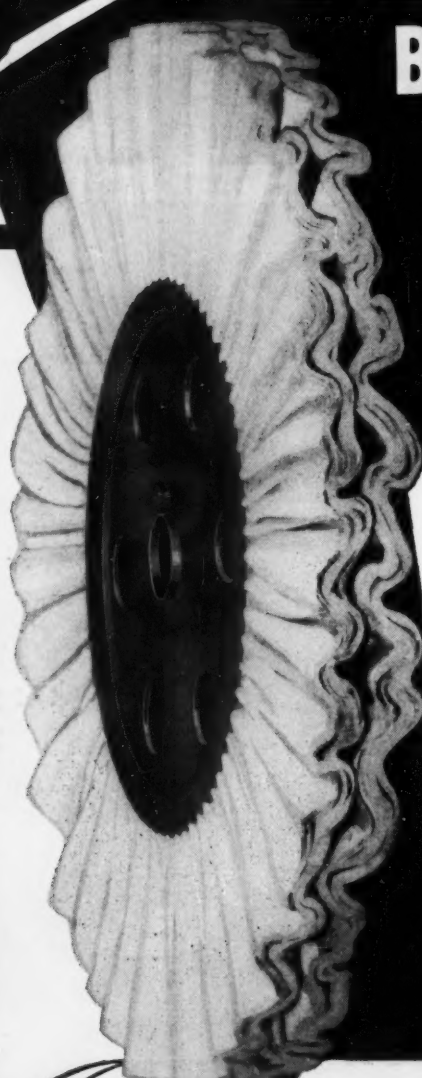
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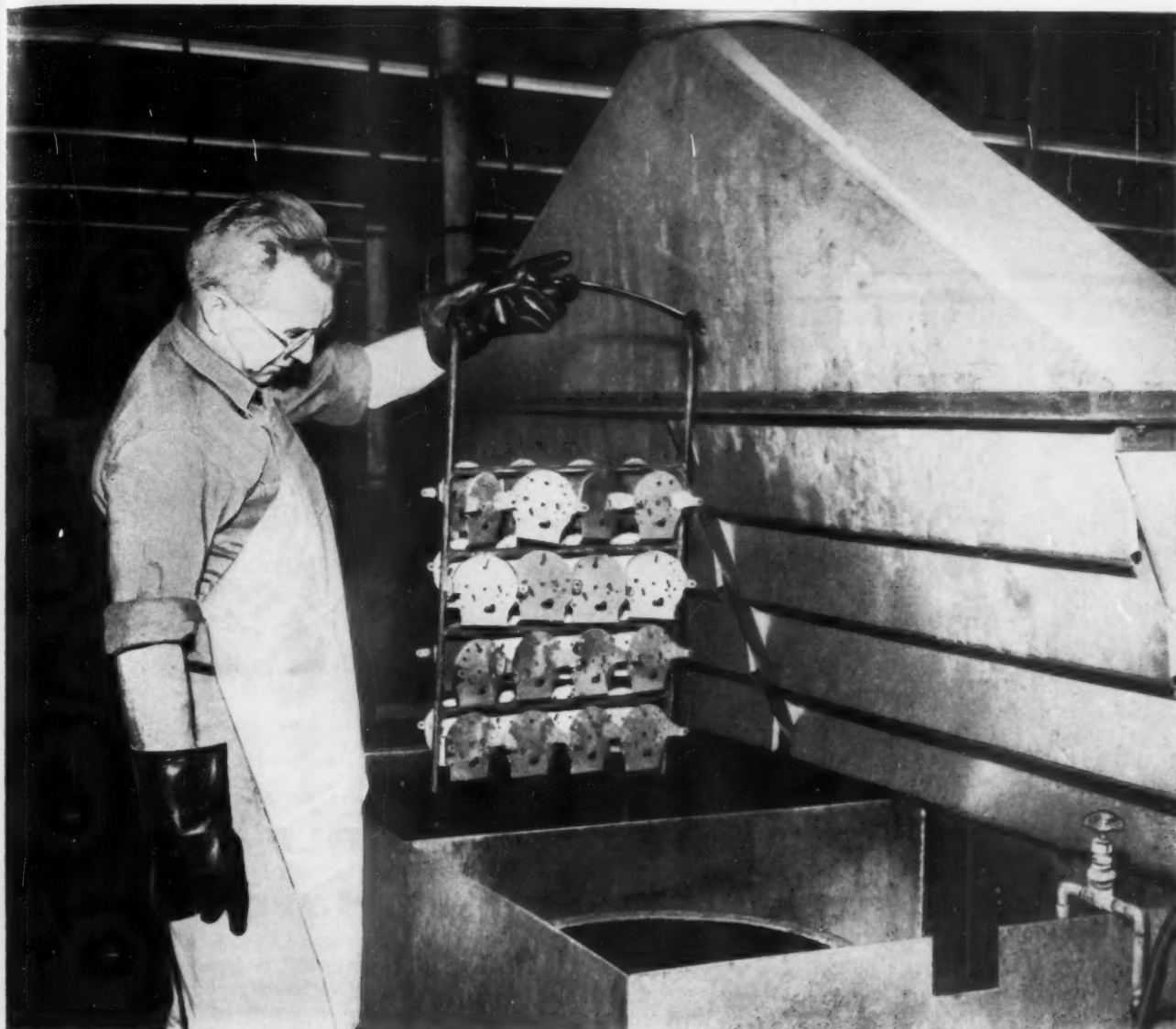


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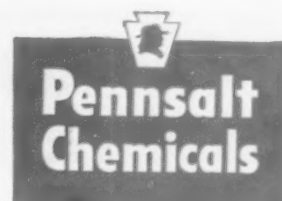
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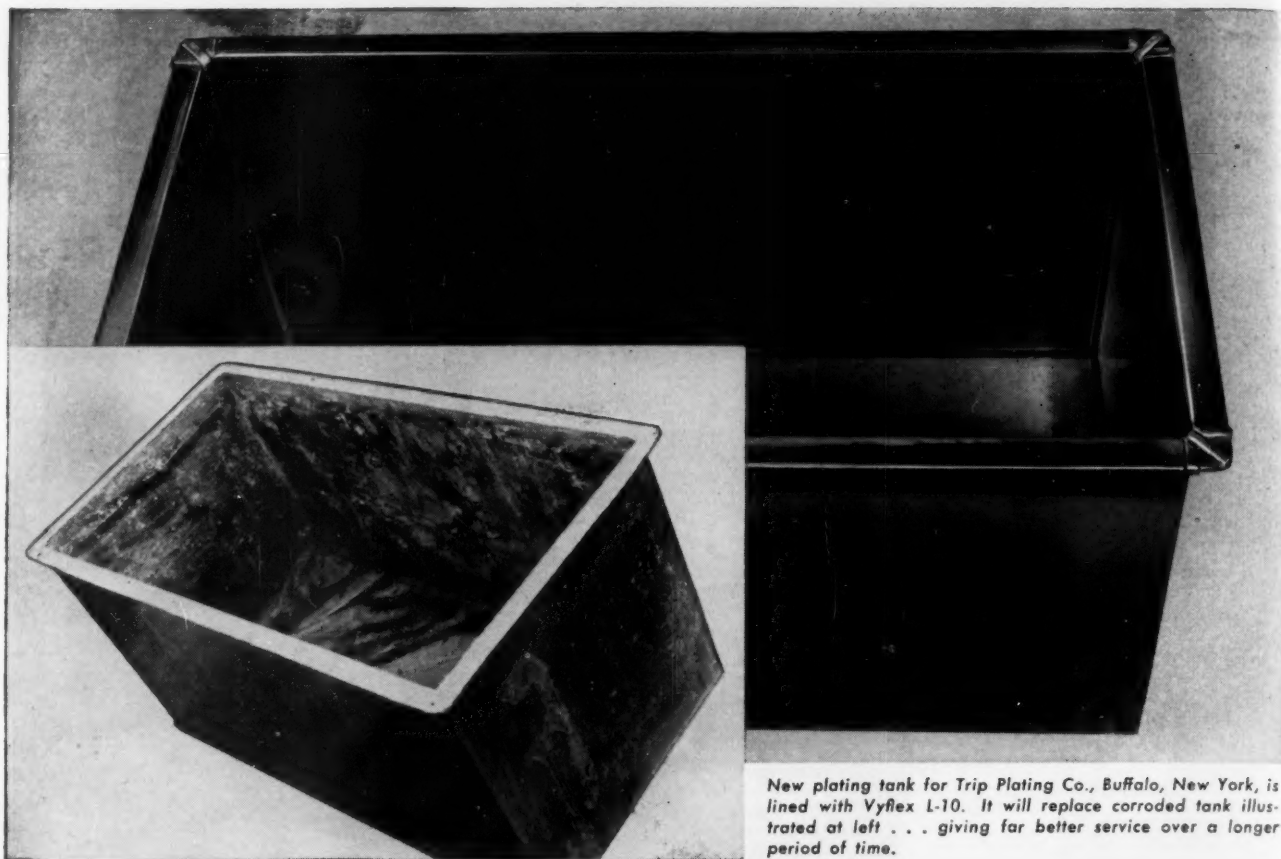
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Vyflex L-10 provides an unparalleled combination of physical properties, too. Because it is inherently elastic, thermal expansion and contraction will not crack L-10, and the effects of mechanical abuse will be minimized. Good insulating properties mean no current loss from L-10 lined vessels in electrolytic reactions. And the inherently smooth, highly polished surface of L-10 simplifies cleaning, speeds solution flow, and provides superior abrasion resistance. The material is available both black and white.

L-10 IS EASIER TO APPLY. Introduction of L-10 means that lining can now be accomplished in the field as well as in the shop . . . accomplished in less time. Whether applied to steel, wood, or concrete, no curing is required. Qualified and experienced lining facilities are available through the greater part of the country.

GET THE FACTS! The complete story on Vyflex L-10 is provided in "Facts You Should Have On Vyflex L-10" and Engineering Bulletin L-10. Write Kaykor Industries for your free copies. Kaykor will also be happy to send you complete information on other Vyflex products, including F-92 Unplasticized Polyvinyl Chloride plate, sheeting, pipe, duct, and fittings; "G" (rubber-resin blend) sheet and plate; and Polyethylene sheet and plate.

Inquiries from lining applicators will be carefully considered.

VYFLEX
TRADE MARK REG. U.S. PAT. OFF.
KAYKOR INDUSTRIES, Inc.

Division of Kaye-Tex Manufacturing Corp.

4403 BROAD STREET • YARDVILLE, NEW JERSEY

KAYKOR INDUSTRIES, INC.
4403 Broad Street
Yardville, New Jersey

Gentlemen:

Please send me, without obligation, the complete details on Vyflex L-10 in "Facts You Should Have On Vyflex L-10" and Engineering Bulletin L-10. ☐ I would also like to have information on the other Vyflex products.

NAME..... POSITION.....
COMPANY.....
ADDRESS.....



News about COATINGS for METALS

Metallic Organic Decorative Protective

Easy change expands chromium plating capacity of existing equipment

Tantalum coil delivers untroubled acid service

At one installation, a Unichrome Tantalum Heating and Cooling Coil had already given 4 years of service in a chromium plating tank when inspected — and was found still as good as the day it was first installed. While initially costing more than lead, an acidproof Unichrome Tantalum Coil or Heat Exchanger proves the most economical in all acid plating solutions.

NEW ROUND ANODES FOR CHROMIUM PLATING

Striking improvement in operating efficiency and money-savings have become possible because of round tin-lead anodes developed by United Chromium.

These cylindrical anodes offer: (1) Longer service life through less corrosion; (2) Greater anode activity which means better current distribution and fewer plating rejects; (3) Greater rigidity which stops warping problems. Write for data.

HELPFUL HINTS

by "Mr. Cost Cutter"



Get superior service from your new lead anodes by taking one simple precaution. When anodes are first placed in the chromium bath, be sure current is flowing. This will put a protective lead oxide film on the surface, instead of lead chromate which accelerates anode corrosion and interferes with current distribution.

UNITED CHROMIUM, INCORPORATED

100 East 42nd Street, New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.

In Canada:

United Chromium Limited, Toronto 1, Ont.

Plant switching to Unichrome SRHS Chromium Solution increases output 66% — slashes rejects, saves power

The experience of a well known plant exemplifies one of the easiest, most economical and successful ways to "expand" a chromium plating department, or reduce its operating costs.

With the ordinary chromium bath, tank load was limited to only six bumpers because of current supply and coverage problems. Even at this rate, rejects due to coverage failures were running high.

Changing the bath to Unichrome SRHS Solution worked wonders. Results with this up-to-date bath were actually better — and cheaper, of course — than physically expanding this plant's capacity. Ten bumpers could be plated per cycle — a 66% increase in output. Coverage improved so strikingly that rejects dropped drastically.

ADVANTAGES CONFIRMED

This is no isolated case of improvement in operations. Many reports verify that Unichrome SRHS Chromium Solutions provide new economy in plating, better coverage and increased productive capacity.

For example: SRHS increased bumper plating 33% at another plant. . . . It reduced bath upkeep costs 40% for still another user. . . . It hard plated work formerly requiring 3½ to 4 hours in only 2½, producing fewer rejects and substantial savings in grinding time as well.



Simply by making up self regulating high speed Unichrome Chromium Plating solution, tanks used formerly for the ordinary solution can do more work.

EASY OPERATION

Because important constituents of Unichrome SRHS Baths are automatically controlled, operation is easy and dependable. The SRHS wide bright plate range avoids "burns" and "misses" on the work. These and other advantages are more fully discussed in Bulletin SRHS-2. Send for it.



NEW MIDLAND PRODUCTION FACILITIES BRING
FASTER SERVICE AND DELIVERY TO USERS OF

Dow Sodium Orthosilicate

A timely reminder about why your industry
prefers this particular heavy-duty cleaning compound

Dow Sodium Orthosilicate, solidly established as the *preferred* heavy-duty cleaning compound, is now available in *greater quantity*. Volume production has been inaugurated at The Dow Chemical Company's Midland Division. These new facilities, added to the Sodium Orthosilicate plant in Freeport, Texas, permit Dow to completely meet the increased demand for this remarkably efficient compound.

The centrally located Midland producing point means, too, that Sodium Orthosilicate orders can be processed more rapidly . . . and your shipment reaches you faster. More floor space is freed from storage demands, yet the cleaning operation can proceed smoothly without any fear of Sodium Orthosilicate shortage.

Dow's new, improved full open-head drum is available for Sodium Orthosilicate shipments from Midland as well as from Freeport, Texas. This superior shipping and storage container, designed and manufactured exclusively by Dow, results in definite transit and handling advantages for the user.

These continuing efforts to bring you an economical and uniformly efficient cleaning compound that really does a heavy-duty job . . . these expansions of production and distribution facilities to serve your needs better and faster . . . these improvements in basic package design to cut your handling and storage costs . . . present a convincing answer to anyone in *your* industry who wonders why Dow Sodium Orthosilicate has won wide acceptance. THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS





STEVENS

**L. V.* RESEARCH
WILL SAVE YOU MONEY...**

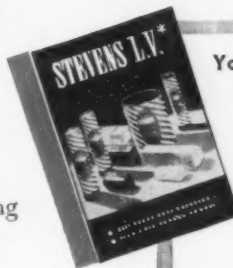
IN YOUR BUFFING AND POLISHING OPERATIONS

Stevens complete metal finishing laboratory facilities are at *your* disposal. And the service is *free*.

If you have a new product requiring a final finish, send samples and a letter outlining your requirements. We will furnish you with a formal Stevens Laboratory-Verified* report showing the final results and recommending the necessary equipment, procedure and the liquid or dry compositions to use.

Or we will check your present operations and advise you of recommended cost cutting improvements in your equipment and sequence of operations — the type of belts, wheels, buffs and the Stevens compositions verified for your job.

Call your Stevens sales engineer, or write direct to arrange for an L.V.* report on your finishing operations. Frederic B. Stevens, Inc., Detroit 16, Michigan.

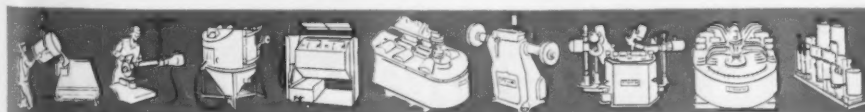


You Can Profit From This Free Booklet!

The Stevens L.V.* Booklet was compiled from hundreds of Stevens L.V.* Reports. It describes up-to-date, laboratory-proved methods for polishing and buffing all types of material and contains many reference tables and other valuable metal finishing information. For your copy, simply send a letter or postcard requesting the Stevens L.V. Report Booklet (No. 51), with your name, company and address.

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PLATING

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RECLAMATION

FREDERIC B. STEVENS



INCORPORATED
YOUR METAL FINISHING SUPERMARKET

DETROIT 16, MICHIGAN

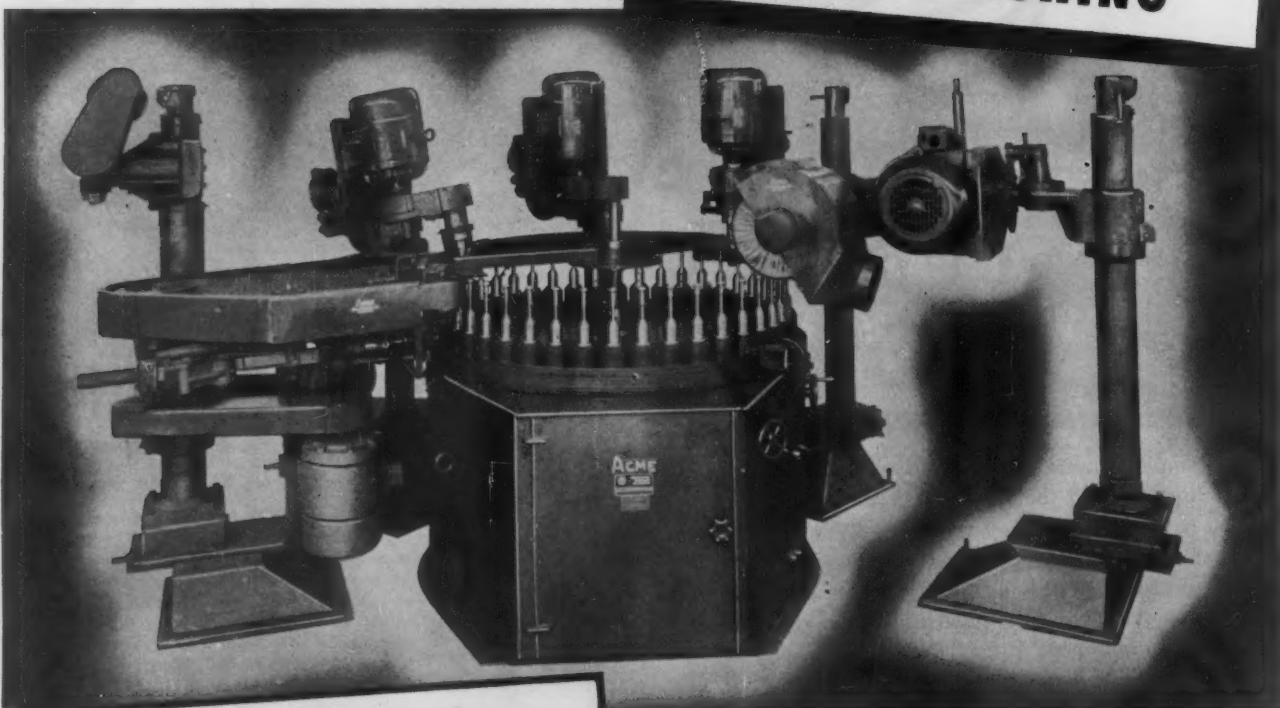
Metal Finishing equipment and supplies from castings or stampings to finished product.

ACME *Automatics*

OFFER THE SOLUTION to MANY PROBLEMS of PRODUCTION FINISHING

Production finishing demands not only high output at low unit cost, but also a uniform finish meeting required standards. Acme Automatics can be depended upon to deliver high production at minimum cost and maintain your finish requirements. Acme performance has been proved in production for nearly half a century.

**POLISHING and BUFFING
DE-BURRING
WIRE BRUSHING
MICRO-FINISHING**



**ROTARY *Automatics*
STRAIGHT LINE *Automatics*
SEMI-*Automatics*
Catalogs on Request**

Recommendations & Quotations

For recommendations, send blue prints of part or samples before and after finishing operations, together with detailed information on finishing operations and production requirements. If production methods will cut your costs, we can set your job up in our experimental processing department and you can inspect the machines in operation.



ACME *Manufacturing Co.*

1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 35 YEARS

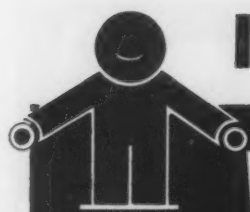
SEYMOUR



NICKEL
ANODES

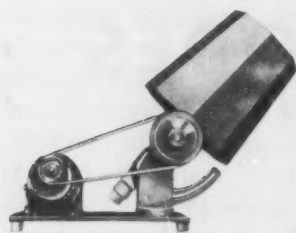
*the
Summit
of
Anode
Quality*

THE SEYMOUR MANUFACTURING COMPANY • SEYMOUR, CONNECTICUT, U.S.A.

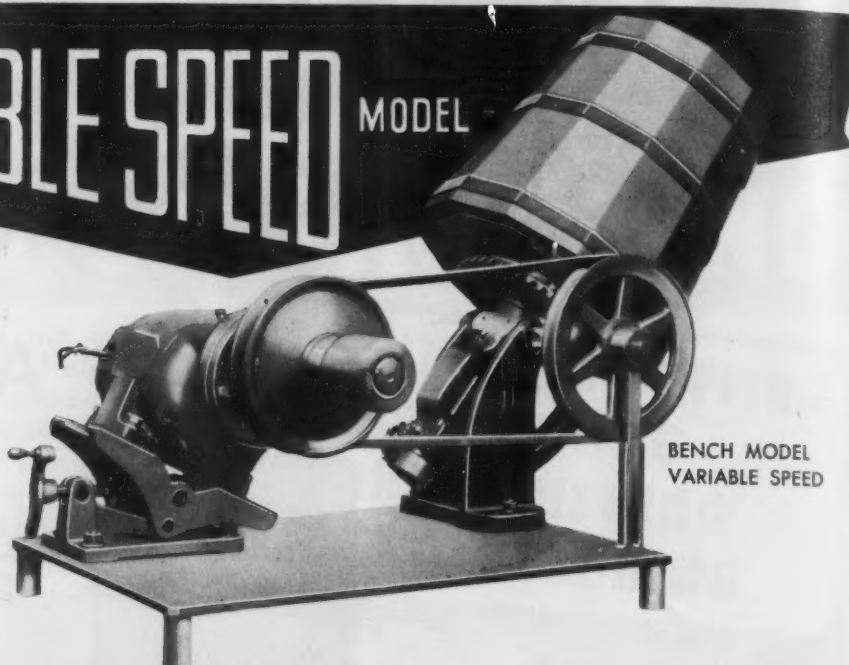


INTRODUCING — our NEW

VARIABLE SPEED MODEL



Bench-Type Single Speed



BENCH MODEL
VARIABLE SPEED

Note Carefully These IMPORTANT POINTS

Barrels can be filled with parts or abrasive — *while running*.

Work can be watched — samples removed for inspection — *while running*.

Angle can be changed for best abrasive or polishing action — *while running*.

Barrels can be emptied by tilting to pouring position — *while running*.

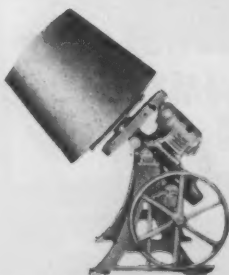
Barrels are made in various sizes, shapes, and materials. They are easily replaced.

If You're a Tumbler, Send
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THE HENDERSON BROS. COMPANY

"The Tumbling Barrel People"

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No. 6—Single Speed



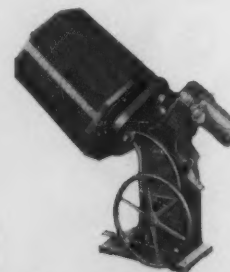
No. 5A—Single Speed



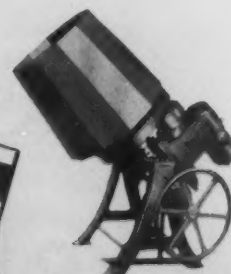
No. 5—Single Speed



No. 5—Variable Speed



No. 5A—Variable Speed



No. 6—Variable Speed



SINCE 1880

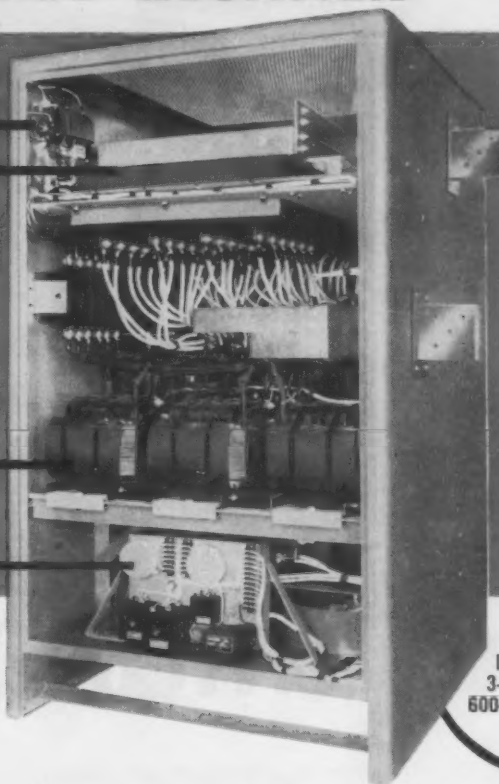
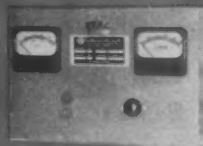
DESIGNERS AND BUILDERS OF TUMBLING BARREL EQUIPMENT





Crown MAGNETIC AMPLIFIER CONTROLLED RECTIFIER

MAGNETIC STARTER
SELENIUM RECTIFIER STACKS
REMOTE CONTROL
PANEL
REACTORS
MAGNETIC AMPLIFIER



**...provides automatic
regulation of either
D.C. voltage or
D.C. current output**

MODEL
RP12-6000
D.C. OUTPUT
3-12 VOLTS AT
600-6000 AMPERES

Simply set the manual selector switch to the type of regulation desired (voltage or current stabilization), and with the manual output control knob, located in the remote control cabinet, smoothly adjust to the desired output value, and your Crown Magnetic Amplifier Regulated Rectifier will maintain DC output at its preset value, regardless of varying load conditions and line voltage fluctuations throughout the treatment time.

For processes requiring constant voltage control, such as decorative chrome plating, anodizing applications, conditions where constant variations in tank loads occur, etc., you will find the automatic voltage stabilization feature highly effective.

For processes such as hard chrome plating, precious metal plating, hard anodizing, etc., requiring DC current

density* to be maintained at a constant value, the automatic current stabilization feature will prove highly desirable.

Like all Crown Rectifiers and Controls the MAGNETIC AMPLIFIER** CONTROLLED RECTIFIER has been thoroughly engineered for trouble-free performance, ruggedly built for extra long life and will efficiently deliver dependable DC power under the most severe operating conditions.

* Upper current limiting is recommended where there is a danger of excessive loads being placed in the tank. It prevents the unit being operated at more than its rated output.

** Magnetic Amplifier Controls have no electronic tubes, powerstats or tap switches. Simple in design (the only moving part is the cooling fan), they require a minimum of maintenance.



For more specific and technical information concerning your application, write Crown Chemical and Engineering Co. today...or contact your nearest authorized distributor.

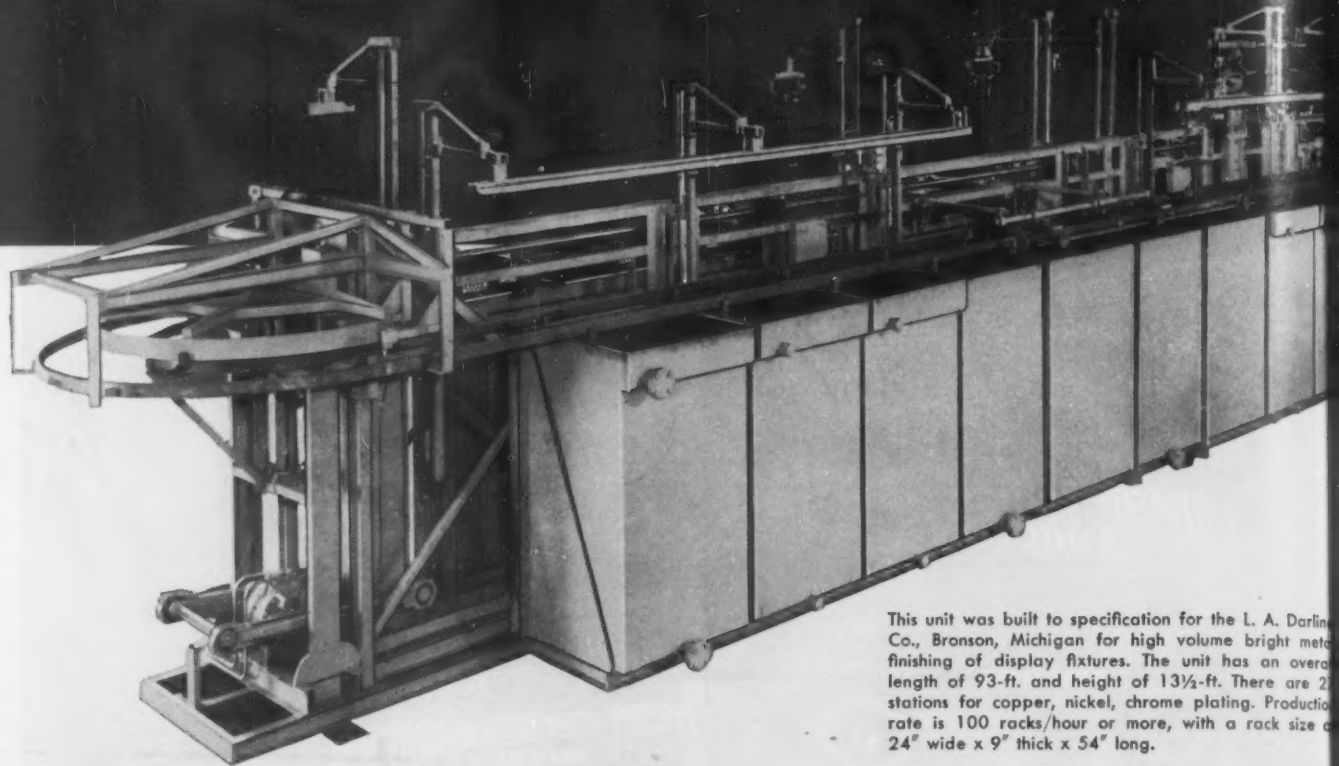
Crown SELENIUM RECTIFIERS

MANUFACTURED BY CROWN CHEMICAL AND ENGINEERING CO. 4722 Worth Street, Los Angeles 63, California

CROWN RECTIFIER DISTRIBUTORS

WEAVER ENGINEERING & SUPPLY, Grand Prairie, Texas • CARMAC CHEMICAL COMPANY, Pittsburgh, Pa.
THE CHEMICAL CORPORATION, Springfield, Mass. • CROWN RHEOSTAT & SUPPLY CO., Chicago, Illinois
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ONLY **Wagner** BROTHERS CAN OFFER YOU THIS

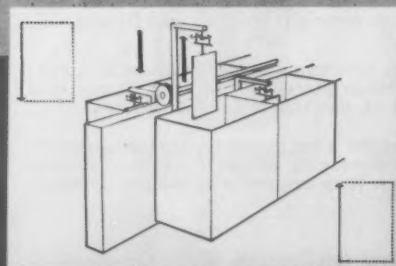


This unit was built to specification for the L. A. Darling Co., Bronson, Michigan for high volume bright metal finishing of display fixtures. The unit has an overall length of 93-ft. and height of 13½-ft. There are 22 stations for copper, nickel, chrome plating. Production rate is 100 racks/hour or more, with a rack size of 24" wide x 9" thick x 54" long.

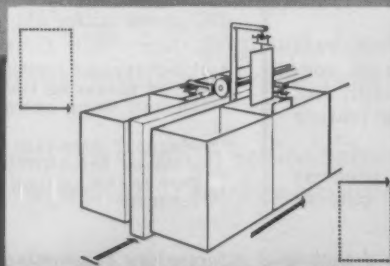
Revolutionary Concept

The Wagner Brothers Automatic is a complete and fully automatic mechanism, incorporating a revolutionary vertical transfer and return type work conveying principle which eliminates elevating superstructure, transfer cams, chains and

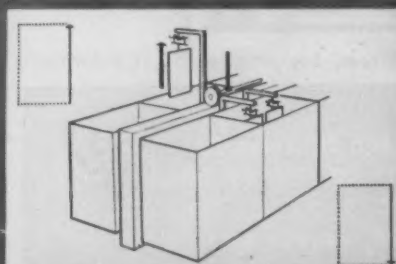
sprockets and hydraulic cylinders above tanks. Many unique design features combine to make this mechanism a smooth operating, perfectly timed unit requiring less than ½ the power of comparably sized units.



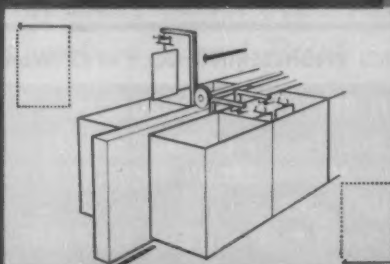
FIRST VERTICAL MOTION



FIRST HORIZONTAL MOTION



SECOND VERTICAL MOTION



SECOND HORIZONTAL MOTION

HOW IT WORKS

All transfer and conveying mechanism is mounted on a reciprocating carriage located between the two rows of tanks. Two basic movements are used to bring parts through the full plating cycle; one forward and reverse straight line horizontal motion and one raising and lowering vertical movement.

Plating racks are attached to work-carriers at the loading station. When the machine is started, lifting arms fixed to the carriage engage the work-carriers being transferred and lift them at all transfer points on one side of the machine, carry them forward to the next station where they are lowered and disengaged from the lifting arm. This sequence is simultaneously produced in reverse on the opposite side so that, when the lifting arms are being lowered on one side, they are raised on the other side.

AGITATOR MECHANISM

Operating independently of the plating machine, a speed reducer furnishes agitation for the nickel plating tank at the rate of 10 to 14 ft./min., with a 3-inch stroke.

END TANK PUSHER ARM ASSEMBLY

Work-carriers, sliding on two electrified rails, are pushed around the end tank by a circular pushing arm and linkage arrangement to a point where they are again engaged by the lifting arms of the carriage to complete the plating cycle.

HYDROMOTORS FOR VERTICAL MOTION

Vertical motions are imparted to the work lifting arms by the two hydromotors mounted on the carriage, connected by rack and pinion gearing by a shaft running the length of the machine. Timing is effectively controlled by the eccentric arrangement on the one hydromotor, causing the arms on one side of the machine to rise while those on the other side are lowered.

HYDROMOTOR FOR HORIZONTAL MOTION

The transfer carriage, suspended on rollers moving over an oil-filled channel track, is actuated by this single hydromotor mounted at the base of the machine. Fitted with a crank and link, the hydromotor translates the simple harmonic motion of the motor shaft to the in-line reciprocating motion of the carriage. Note the convenient, easily accessible grouping of limit switches on the frame. Only four are required for the entire machine.

semi-automatics • precision hard chrome units • plating barrels • tanks and linings filters • rectifiers • anodes solutions • supplies.

ADVANTAGES

SMOOTH OPERATION—Operates so smoothly that you can balance a full water glass on the transfer mechanism throughout the entire plating cycle. Obviously such smooth operation will save you time now spent salvaging parts from tanks, dropped there because of the jolting transfer action of ordinary machines.

LOW POWER REQUIREMENTS—Powered by one 10 hp motor, this installation uses less than half the power required by comparably-sized units.

MINIMUM OF MAINTENANCE—There are few moving parts to wear, no vibrating parts, no backlash in automation, nor little chance of misalignment. Overload protection is given by a by-pass in the hydraulic pump which prevents destructive jamming. All working parts can be reached for adjustment without disassembly. Maintenance is reduced to a fraction of that usually required.

IN PLATING AUTOMATION

SIMPLE INSTALLATION—Your Wagner Brothers Automatic is delivered to you, either intact or in two or three completely assembled sections, depending upon size. Installation is simply a matter of positioning and leveling. You can imagine the savings in installation costs ordinarily required.

OTHER PLUS FEATURES—Wagner Brothers Automatics require a minimum of space. The model illustrated uses 54-inch racks and operates under a 13½-ft. ceiling. There are no greased parts or hydraulic fittings over tanks where dripping oil could contaminate solutions. Triple contacts on cathode bars afford consistent, uninterrupted current flow. Automatic heat control system gives simple, foolproof regulation of temperature for accurate results. Centralized lubrication can be provided as an optional feature. Drag and dwell times are easily varied with this unit.

In addition to high-volume plating, the Wagner Brothers' Automatic is equally well-suited to anodizing (sulphuric and chromic), phosphate coating, etching, electropolishing, oxide coating.

YOUR PRIMARY SOURCE FOR PLATING AND POLISHING EQUIPMENT AND SUPPLIES

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WAGNER BROTHERS, INC., 418 Midland Ave., Detroit, Mich.

☐ Please send information describing Wagner Brothers Automatics

☐ Please send name of representative

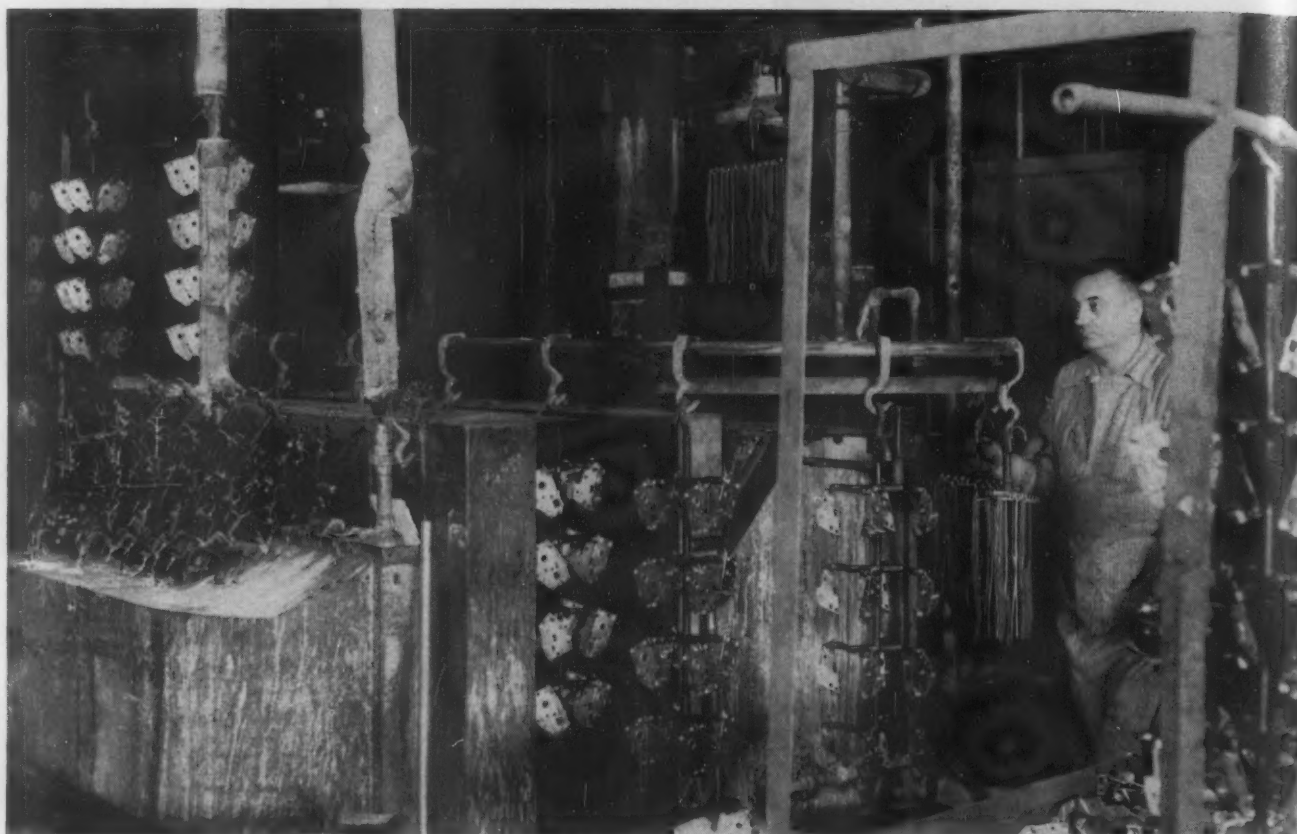
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AT THE STANDARD PRODUCTS CO., CLEVELAND...



Using fully automatic plating equipment, The Standard Products Co. turns out an average of 12,000 auto door locks per day.

"Du Pont ZIN-O-LYTE* Always Gives Bright, Uniform Zinc Deposits—Without Bright Dipping!"

—says John Savage, plating foreman, Reid Products Division

"With 'Zin-O-Lyte' brightener, extra rinse and bright-dip tanks are unnecessary—a valuable space-saving feature," continues Mr. Savage. "And we find the zinc-plating baths easy to control... economical to operate."

Standard Products plates about 6000 lbs. of locks and allied parts a day. Since installing fully automatic plating equipment 6 years ago, their Reid Products Division has obtained trouble-free plating of the highest quality with Du Pont "Zin-O-Lyte" zinc plating chemicals.

Like Standard Products, you can get blue-white, rust-resistant deposits—over a wide range of current density—directly from the bath! These zinc-plating baths are effective on parts of all shapes and sizes... in any type equipment, particularly barrel plating.

For more information about Du Pont plating processes and chemicals call your nearest district office or mail coupon below.

DISTRICT OFFICES:

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit • El Monte (Calif.) • Kansas City† • New York • Philadelphia • Export Division, Wilmington, Del.

* Reg. trade-mark for Du Pont zinc plating chemicals

†BARADA & PAGE, INC.

Chemicals • Processes • Service
for **ELECTROPLATING**



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Dept., MF-12, Wilmington 98, Del.

Please send me more information on Du Pont Plating Chemicals—properties, advantages and recommended procedures. I am interested in the following types of plating:

- | | |
|--|---|
| <input type="checkbox"/> Cadmium Plating | <input type="checkbox"/> Tin Plating |
| <input type="checkbox"/> Zinc Plating | <input type="checkbox"/> Copper Plating |

Name _____

Firm _____

Street & No. _____

City _____ State _____



Note size of new dip-tank. Supervisor is shown inspecting it at the Davies plant, prior to its installation in pit.

Giant Dip-Tank Paves Way To New Uses For DAVYNOL

A new dip-tank, one of the largest in the U. S., was recently installed at the modern Davies plant in St. Louis.

The new tank was originally intended to increase capacity for Davynol-coating of Davies plating racks... larger and longer racks than could be handled before are now coated easily... however, because new applications for Davynol are being discovered, the tank is also used for coating a variety of industrial equipment such as duct-work, tanks, conveyor racks, and roller conveyors.

The reason for Davynol's increasing use is its com-

plete resistance to acids, alkalis and other corrosive solutions. Wherever a tough protective coating against corrosion or abrasion is required, Davynol does the job by combining durable resistance, rugged tensile strength, permanent flexibility, continuous adhesion and positive insulation.

Perhaps Davynol can help make *your* product better or increase efficiency in *your* plant. Davies engineers are interested in finding out... let them hear from you if you have any corrosion or abrasion problems or any questions about Davynol. They'll be glad to advise you.

WRITE today for complete information!



**Davies represents these
"blue ribbon" firms in the
Great Southwest.**

- THE UDYLLITE CORPORATION
- FREDERICK B. STEVENS, INC.
- MacDERMID, INC.
- ALLIED RESEARCH PRODUCTS (Iridite)
- ROTO-FINISH CO.
- ALROSE CHEMICAL COMPANY (Jetal Process)
- CIRCO EQUIPMENT COMPANY
- INDUSTRIAL ELECTROPLATING CO. (Niehaus Fume Separators)
- METALWASH MACHINERY CORPORATION
- R. O. HULL AND COMPANY

— and many others

Davies

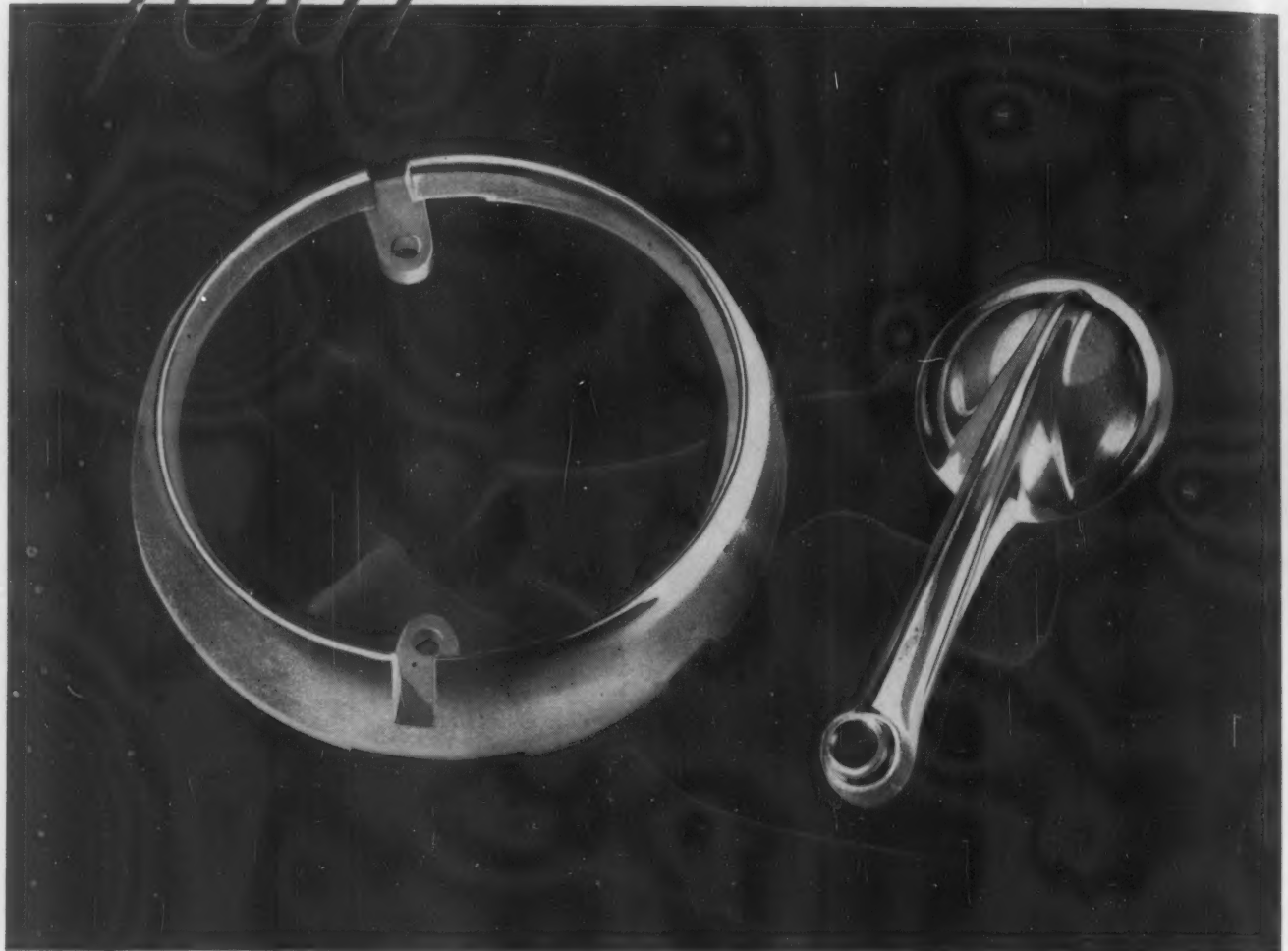
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YOUR

DIE-CASTINGS!



**Satisfied with your Finish?*

** looking for the best finish possible within the range of competitive production costs?*

Investigate our Lea-Ronal Bright Copper Process with Lea Copper-Glo.

You can secure the same following advantages as the numerous present users of the Lea-Ronal Bright Copper Process:

- it produces a brilliant, soft ductile deposit, ideal for subsequent bright nickel or chrome plating.
- it reduces nickel requirements because nickel is not needed to build brightness.
- high speed plating.
- the brighteners are completely stable—even when idle for prolonged periods.
- carbonates tolerated to saturation without any harmful effect on plating range.

- can operate with mechanical or air agitation.

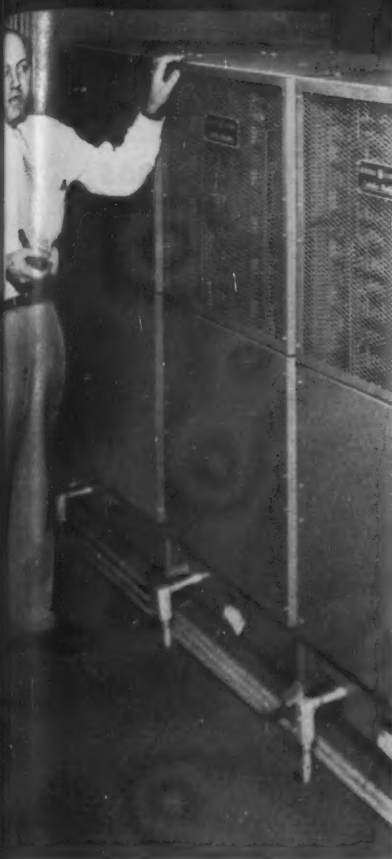
There are other advantages but these six—all outstanding—will give you an idea as to what you can expect if you convert your tanks—still or barrel—to the Lea-Ronal Process using Lea Copper-Glo. Ask for a laboratory test sample. Better yet, order sufficient quantity to make a good trial production run in your plant. Write or phone The Lea Mfg. Co., 16 Cherry Avenue, Waterbury 20, Conn., through whom the Lea-Ronal Bright Copper Process and Lea Copper-Glo are exclusively marketed.

If you have a technical problem on copper plating on which our engineering staff could be of help, tell us about that, too.

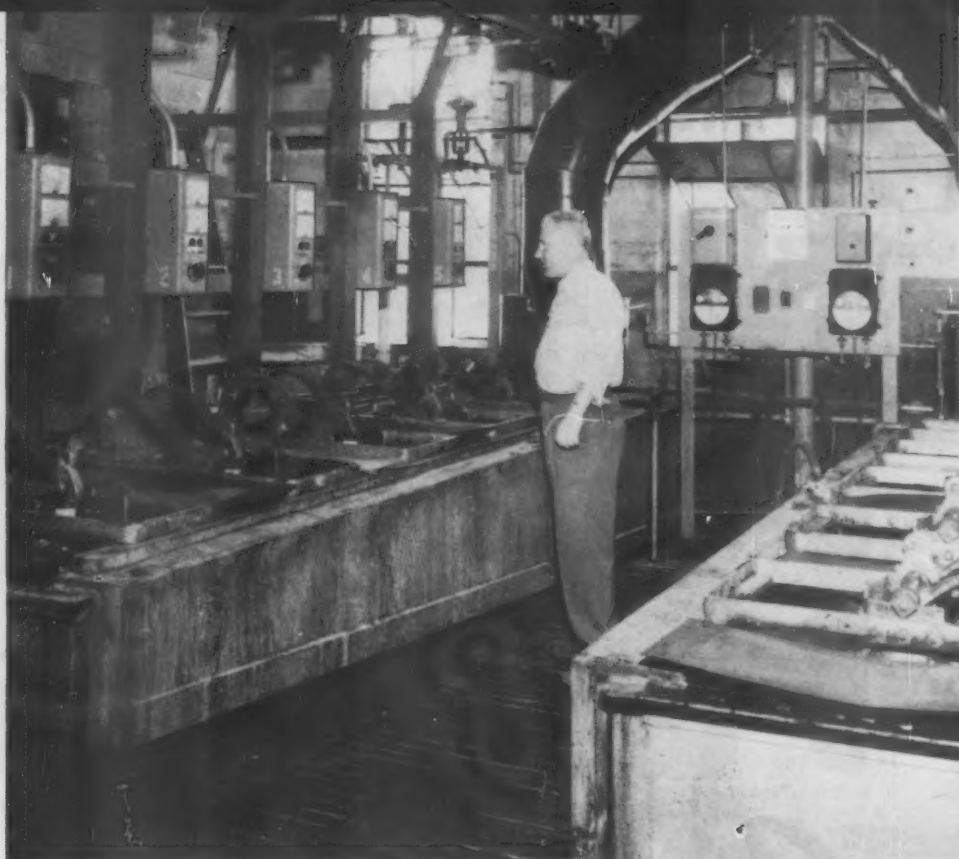


Lea-Ronal, Inc.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.
Main Office and Laboratory:
42-48 27th Street, Long Island City 1, N. Y.



G-E RECTIFIERS located in a separate room leave more space for plating tanks, and avoid the corrosive atmosphere.



INSPECTING THE CONTROL STATION at one of the tanks where piston rings are being chrome plated. The operator's control station permits regulation of the voltage level at each tank by controlling the d-c output of the G-E rectifier units located in another room.

G-E Plating Rectifiers Help To Triple Capacity of Plating Room at Muskegon Piston Ring Co.

New General Electric plating power supplies have enabled the Muskegon Piston Ring Company of Muskegon, Michigan, to triple its plating capacity in the same working space. By mounting copper oxide rectifiers on an enclosed balcony outside the building, with a separate operator's control station at each plating tank, Muskegon was able to use the entire floor space for plating tanks.

COMPLETE FLEXIBILITY of plating room arrangements is provided by General Electric rectifier units. Not only is it possible to install the rectifiers away from the plating room, thus freeing space for additional tanks, but the rectifiers are kept clear of the corrosive plating room atmosphere as well.

LESS MAINTENANCE is required for G-E rectifier plating power supplies. The scarcity of moving parts means less maintenance, since only the cooling fan

requires lubrication. Installation costs are less, since G-E plating rectifiers require no special foundation.

Operating costs are lower, because G-E rectifier units assure you of the most efficient application of either copper oxide or selenium with the proper circuit for each voltage rating.

AUTOMATIC REGULATION is available as an integral part of G-E plating power supplies, or can be added later to manually-controlled units. In addition to manually and automatically-controlled units, economical 12-volt barrel platers are available in ratings from 500 to 2000 amperes.

ADDITIONAL INFORMATION on any of General Electric's plating power supplies is available from any authorized G-E agent listed, or by writing Section 464-16, General Electric Co., Schenectady 5, N. Y.

G-E PLATING POWER SUPPLIES ARE SOLD BY THESE AUTHORIZED AGENTS:

- AMERICAN FACTORS LTD., Honolulu, T.H.
- M. E. BAKER CO., Cambridge, Mass.
- BELKE MFG. CO., Chicago, Ill.
- THE CHEMICAL CORP., Springfield, Mass.
- CLEVELAND ELECTRIC CO., Atlanta, Ga.
- CONNECTICUT ELECTRIC EQUIPMENT CO., INC. Meriden, Conn.
- ENTHONE CO., New Haven, Conn.
- FITZPATRICK ELECTRIC SUPPLY CO., Muskegon, Mich.
- W. M. FOTHERINGHAM CO., Buffalo, N. Y.
- GENERAL ELECTRIC SUPPLY CO., Cleveland, Ohio
- FRED GUMM CHEMICAL CO., Kearny, N. J.
- J. & H. ELECTRIC CO., Providence, R. I.
- LASALCO, INC., St. Louis, Mo.
- LEA MANUFACTURING CO., Waterbury, Conn.
- WILLIAM LYNN CHEMICAL CO., INC., Indianapolis, Ind.
- MEAKER CO., Cicero, Ill.
- CARL F. MILLER CO., Seattle, Wash.
- J. C. MILLER CO., Grand Rapids, Mich.
- GEORGE L. NANKERVIS CO., Detroit, Mich.
- REYNOLDS-ROBSON SUPPLY CO., Philadelphia, Pa.
- STANDARD PROCESS CORP., Chicago, Ill.
- STANDARD WHOLESALE SUPPLY CO., Las Vegas, Nev.

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THE ANSWER TO YOUR TANK HEATING PROBLEMS

FOR ACID HEATING JOBS

FOR ALKALINE HEATING JOBS



G SERIES FUSED QUARTZ IMMERSION HEATERS

Over 40,000 CLEPCO Fused Quartz Heaters now in service.

Dependable, controlled heat at low operating cost.

Wide range of Standard Sizes for every need.

Only Fused Quartz Heater recommended and sold by all leading plating supply houses.



W & WS SERIES STEEL AND STAINLESS IMMERSION HEATERS

Specify CLEPCO Non-Magnetic Stainless Steel Heaters for your alkaline electro cleaners and bright copper plating tanks.

Specify CLEPCO Steel Heaters for all other alkaline tanks.

All leading Plating Supply Houses can furnish from stock.



SEE YOUR PLATING SUPPLY HOUSE

WRITE US FOR LITERATURE

Clepco

CLEVELAND PROCESS COMPANY

1965 EAST 57th STREET
CLEVELAND 3, OHIO

Guaranteed

FRAY-PROOF

Performance!

with **JOE-D** — the Original
Bias Sisal Buffs

Because they're cut on the bias, JOE-D Bias Sisal Buffs give actual *fray-proof* performance. No loose ends to whip or scratch . . . always an even nap to hold compound and provide better color. Made of only the finest imported Sisal, specially treated to eliminate brittleness and run *clean*. For high-quality, high-volume production, insist on genuine JOE-D Bias Sisal Buffs!

Available with steel or fibre-board centers. Also complete selection of Conventional and Bias Spoke (Finger) Sisal Buffs.

JOBBERS!

A few choice territories still open — WRITE TODAY!



Holders of the original patent on
Bias Sisal Buffs (U.S. PAT. No. 2642706)

the **JOE-D** Buff Company

SANDWICH, ILLINOIS • TELEPHONE 2171

HARSHAW ANODES and CHEMICALS

You can depend on Harshaw products to keep your production moving. For more than fifty years we have concentrated on improving the quality of the anodes and chemicals used by platers.

NICKEL PLATING

... still and barrel ... nickel anodes—all commercial grades and sizes ... anode bags ... single nickel salts—nickel chloride ... nickel carbonate ... nickel fluoborate ... boric acid.

CHROMIUM PLATING

... pure "Krome Flake" 99.8% CrO_3 ... sulphates less than .10% ... lead, tin-lead and antimony-lead anodes.

COPPER PLATING

... copper ball anodes ... Rochelle Salts ... sodium and copper cyanides ... copper sulfate ... copper fluoborate.

CADMIUM PLATING

... ball and cast cadmium anodes ... cadmium oxide ... sodium cyanide ... cadmium fluoborate.

TIN PLATING

... cast tin anodes ... sodium stannate ... stannous sulfate ... tin fluoborate ... acid tin addition agent.

ZINC PLATING

... ball and cast zinc anodes ... sodium and zinc cyanide ... zinc sulfate ... zinc fluoborate.

LEAD PLATING

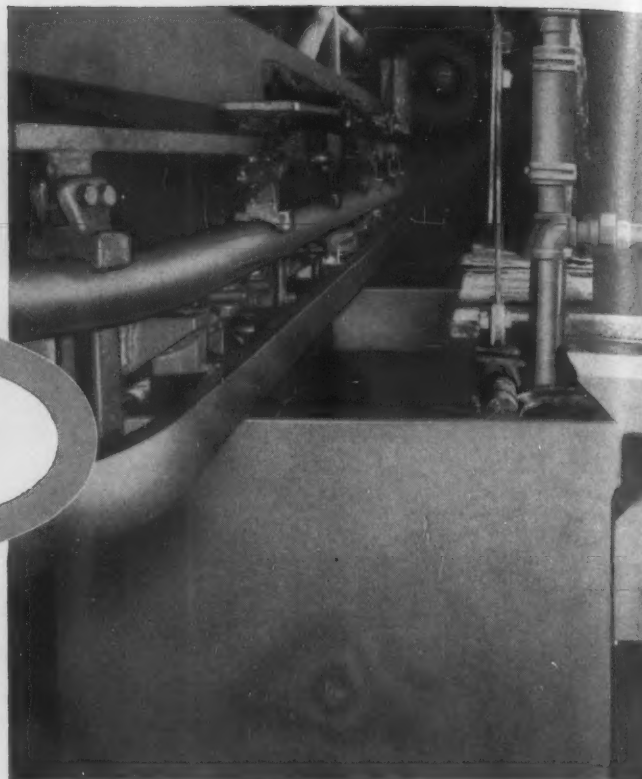
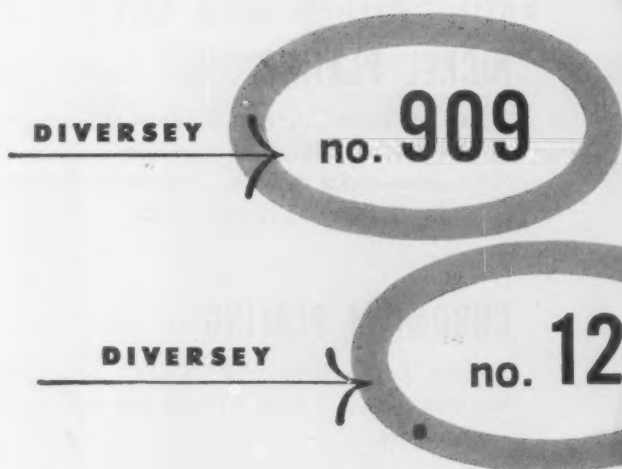
... cast lead anodes ... lead fluoborate.

SILVER PLATING

... silver cyanide.

The HARSHAW CHEMICAL Co., Cleveland 6, Ohio

Chicago 10, Ill. • Cincinnati 13, Ohio • Detroit 28, Mich. • Houston 11, Texas
Los Angeles 22, Calif. • Philadelphia 48, Pa. • Pittsburgh 22, Pa. • New York 17, N. Y.



Loading end of fully-automatic cadmium line at Miller's Jackson, Michigan plant.

MILLER PLATING CORP. says:
JACKSON, MICHIGAN

"No Finer Cleaners are to be Found...Anywhere!"

Diversey is proud of this endorsement from busy, well-known Miller Plating in Jackson, Michigan. Metal cleaning at Miller's is both manual and fully automatic. And to meet Miller's rigid standards, cleaners must be outstanding performers.

SAYS MR. H. E. WELCH, MILLER CORPORATION VICE-PRESIDENT:

"We have used Diversey Products exclusively in soak and electro-cleaning operations prior to all types of decorative and rustproof plating for over three years. We believe no finer cleaners are to be found anywhere!"

HERE'S WHAT DIVERSEY NO. 909 AND NO. 12 OFFER YOU:

No. 909 is a unique, caustic-free, heavy-duty soak tank cleaner for any metal. No. 12 is an electro-cleaner. It's exceptional in that it may be used with either direct or reverse current . . . has a controlled foam blanket to materially reduce the explosive hazard . . . has such high conductivity that you're assured full loading of tanks thereby increasing production and cutting costs. No. 12 is perfect for shops with limited power capacities.

LOOK INTO THESE TWO OUTSTANDING DIVERSEY CLEANERS:

They'll do a better job for you, cut your costs. Write today for additional information, or call your Diversey D-man.

Please send me more information about

- ☐ Diversey No. 909
☐ Diversey No. 12

NAME _____

FIRM NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Send to:



THE DIVERSEY CORPORATION

1820 ROSCOE STREET, CHICAGO 13, ILL.

IN CANADA: THE DIVERSEY CORPORATION (CANADA) LTD. PORT CREDIT, ONT.

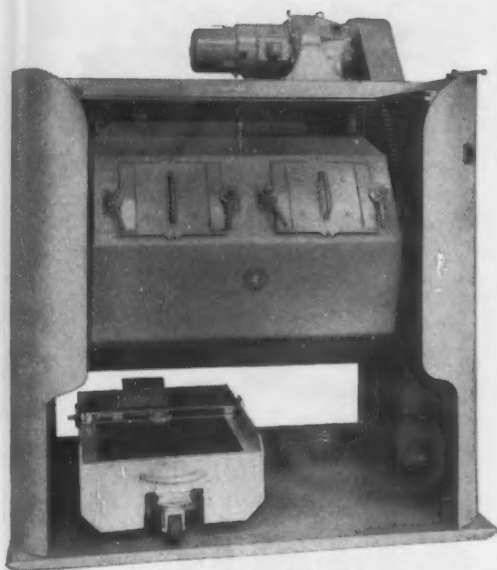
CROWN TUMBLE

DEBURRING EQUIPMENT

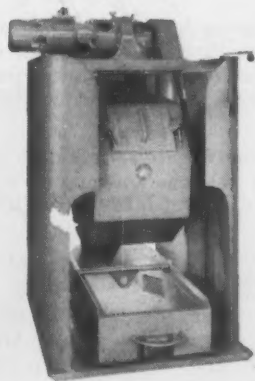
To deburr and tumble finish metal parts

Crown's complete line of newly improved tumbling machines and labor saving accessories provide huge savings in time-costs and labor.

- Light weight — quick acting "seal tight" doors with easily replaceable gasket.
- Front safety guard.
- Forward and reverse switch to rock barrel in rinsing and to position doors for loading and unloading.
- Easily accessible motor and bearings.
- Rubber lined — Neoprene lined — unlined.
- Special machines designed and built.



2 Compartment
Horizontal Tumbling Machine



Single Compartment
Horizontal Tumbling Machine



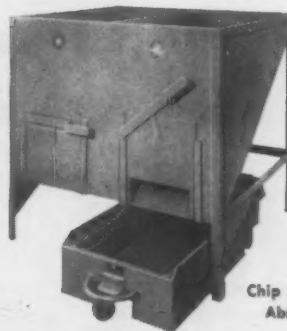
Mechanical Separating Table
Hoist Pan Type



Separating Table
Hand Type



Separator — Meter Drive
with Hopper



Chip or Tumbling
Abrasive Bin

WRITE FOR OUR COMPLETE CATALOG OF TUMBLING MACHINES AND ACCESSORY EQUIPMENT

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

FOR PRECISION STOPS...



IN SELECTIVE PLATING...

MICCROSTOP

... is designed to achieve an accurate line of demarcation in all plating cycles. It will go through cleaners and hot solutions without losing its exceptional adhesion, unsurpassed on sharp edges. The finest all purpose stop-off lacquer on the market today.

MICCROMASK

... is specifically designed for maximum adhesion in hard chrome plating. It will hold to a fine line and may be easily removed after plating. Dries rapidly. Multiple coats will take any long cycle without treeing.

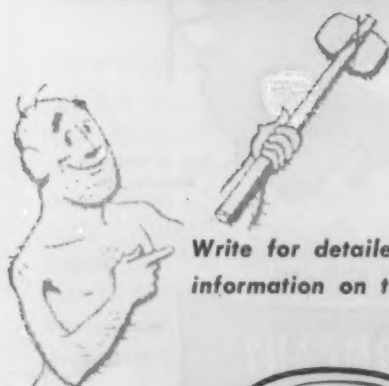
Note: Both MICCROSTOP and MICCROMASK may be removed easily in MICROSTRIP A.

MICCROWAX

... C-562 is the outstanding product for the most efficient method of selective hard chrome plating. Melting at 180°F, it is especially applicable for flat surfaces and sharp edges, where dipping is feasible.

... C-600 will take all plating cycles without losing adhesion. Melting at 300°F, it is not affected by temperatures, acids, or caustics used in any plating operation.

Both MICCROWAX C-562 and C-600 may be reused. Only one dip tank is required. Both harden immediately, cutting down application time to a minimum.



Write for detailed bulletins giving full information on the above products.



MICHIGAN CHROME and Chemical Company

8615 Grinnell Avenue • Detroit 13, Michigan

BUY UDYLITE'S LONG EXPERIENCE IN **GET** BARREL PLATING APPLICATIONS THE EQUIPMENT THAT IS TAILORED TO YOUR SHOP PRODUCTION



Since 1936 when Udylite introduced the first standardized plating barrel with interchangeable parts, it has been on the move through research, engineering and production.

Through these 18 years the Udylite Barrel Plater has progressed with hard rubber, bakelite, melamine and lucite and now the latest development, Tempron. Over 8,000 barrels have been put into customer use.

Each new material, every new engineering detail and every planned operation in this never ending parade of progress has been long studied and operation tested for months before offering to industry.

All Udylite Barrel Equipment is engineered,

manufactured and customer plant planned in complete coordination with Udylite Electrical Engineers and Laboratory Technicians.

Regardless of the size of the installation or the equipment involved, Udylite experience and coordinated know-how are always the plus values of incalculable worth—and they are free.

You owe it to yourself—when you have small parts plating problems—to consult Udylite.

*Write for Bill Jackson's article
"Horizontal Plating Barrels and
Auxiliary Equipment."*

THE
Udylite
CORPORATION
DETROIT 11, MICHIGAN

**WORLD'S LARGEST
PLATING SUPPLIER**



FOUNDATION

makes the difference

put your finish on a sound phosphate base . . .

NORTHWEST INTERLOX

Interlox was developed by Northwest's Cleaning Specialists to give you a better, more corrosion resistant, more easily controlled phosphate base for your organic finishes. It exceeds most government specifications.

Deposited as a fine, dense grain coating, Interlox is designed for spray or immersion type baths—zinc phosphate coatings or iron phosphate coatings.

Interlox deposits at a very rapid rate thus assuring a high-quality, uniform coating throughout the unusually long life of the bath.

Northwest's production-tested chemicals and "Right the First Time" recommendations will save you money. For the complete story on Interlox or any of the other Northwest Chemicals write or phone for a Cleaning Specialist.

Got a problem?
Let our cleaning
experts help you!



NORTHWEST CHEMICAL CO.

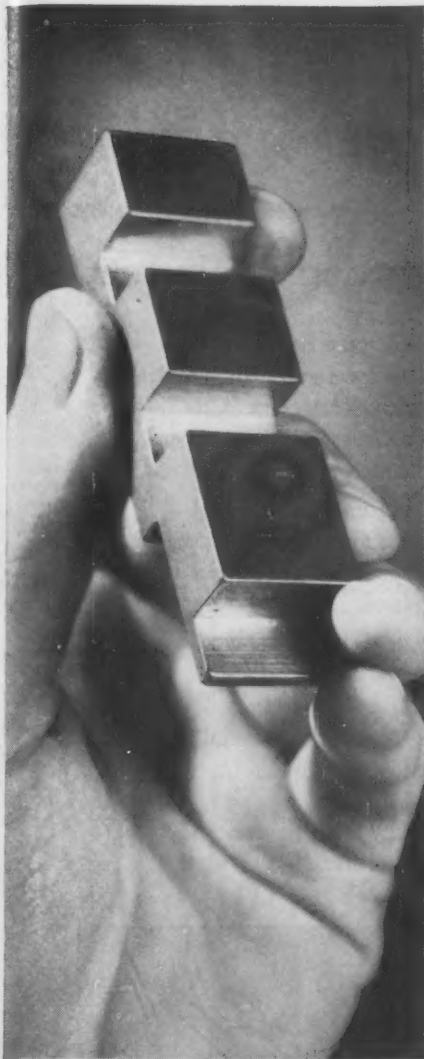
9310 ROSELAWN

DETROIT 4, MICH.

pioneers in pH cleaning control



serving you since '32



This part once cost 21½¢ per piece to finish. The manufacturer investigated barrel finishing and decided to give it a trial.



This method — barrel finishing — proved a sensational cost cutter. The medium is Norton ALUNDUM® Tumbling Abrasive. The cost per finished part today is 5½¢!



This abrasive, a typical Norton finishing development, is sharp, dense, hard and non-fracturing. Its blocky shape eliminates slivers and chips in the process.

Cost on this piece cut 75% with barrel finishing abrasive

"TOUCH of GOLD" *enjoyed as Norton ALUNDUM Tumbling Abrasive goes to work*

This finished part tells the story in a jiffy.

Once the work entailed "hand-deburring" at a cost of 21½¢ per piece. Now barrel finishing with Norton ALUNDUM abrasive does the job and the cost is 5½¢ per piece.

Besides the savings, these other advantages were also gained: **Uniformity**

of radii and surface . . . Brighter color . . . Smoother finish.

Are you taking advantage of Norton ALUNDUM tumbling abrasive in your work?

See your Norton Distributor for further facts. Or write to NORTON

COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in the yellow pages of your phone book. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. G-280

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Making better products . . . to make your products better



and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

avoid stream pollution due to chromium waste...

...with W&T

Sulphur Dioxide Reduction Equipment

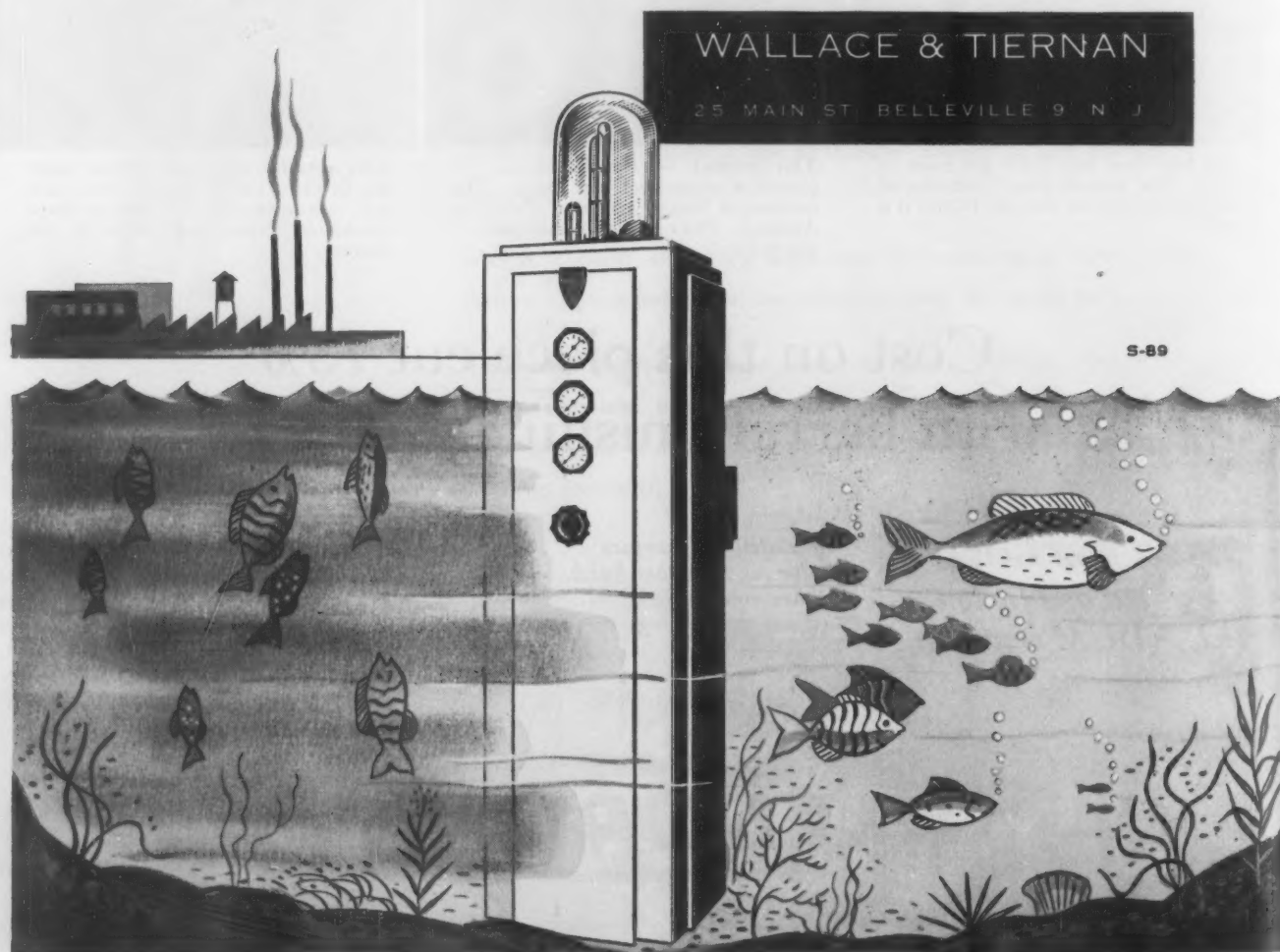
With the proper treatment equipment, toxic hexavalent chromium can be reduced by sulphur dioxide to the trivalent form and then completely precipitated by alkali for standard removal to a disposal area — such as a lagoon. After this treatment the waste water can be drawn off and safely disposed of in the usual manner. This treatment is in full compliance with most local and state pollution abatement laws.

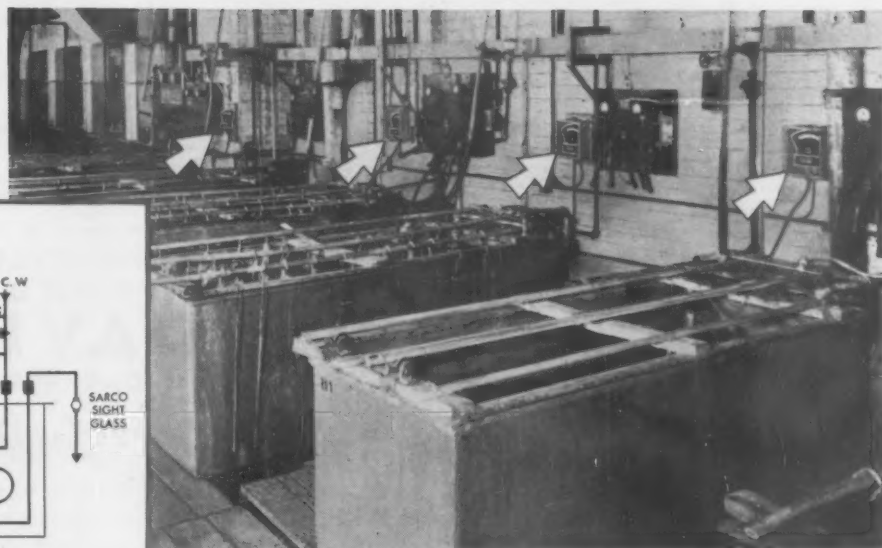
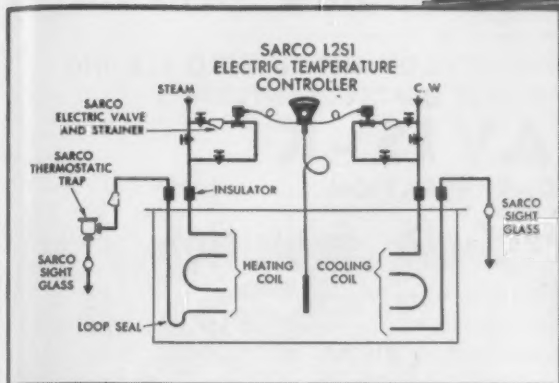
Wallace & Tiernan offers the heat treating and metal finishing industries several types of Sulphur Dioxide Feeders with optional controls for manual, semi-automatic or fully automatic operation. These feeders are adaptable to either the "batch" or "flow-thru" methods of treatment in both large and small plants.

Similar equipment is also available for the destruction of cyanide waste by alkaline chlorination.

W&T offers **PROVEN EQUIPMENT** — hundreds of similar units are serving industry today, **EXPERIENCE** — over forty years of building chemical feeding equipment, and **SERVICE** — field representatives are located in principal cities throughout the country.

Write today for additional information on W&T Sulphur Dioxide Feeders and Alkaline Chlorination Equipment, at no obligation to you, of course.





▲ Over 30 Sarco Electric Temperature Controllers help maintain high quality plating at Ronson Art Metal Works, Inc., Newark, N. J. Controllers are used on chrome, nickel, copper, silver and gold plating tanks.

Why RONSON relies on Sarco Temperature Controllers for high quality plating

RONSON, manufacturer of the "World's Greatest Lighter," knows that high quality plating depends upon close control of many variables, the most important of which is the bath temperature.

They know that erratic bath temperatures usually result in costly rejects, wasted man hours, and disassociation of expensive solutions.

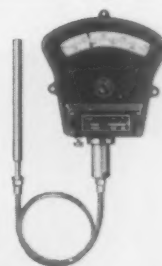
In 1948, Ronson made trial installations using Sarco LSI Electric Temperature Controllers and other competitive devices. The Sarco LSI's

proved superior on all counts: dependability, cost, ease of installation, and maintenance.

As a result, LSI's are now standard equipment at Ronson. Mr. J. Rembecki, metallurgical engineer, reports that Sarco LSI's have given trouble-free service for over five years.

For information on how Sarco LSI's can cut your plating costs, ask for Bulletin No. 6. Call your local Sarco agent, or write direct to Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.

SARCO improves product quality and output



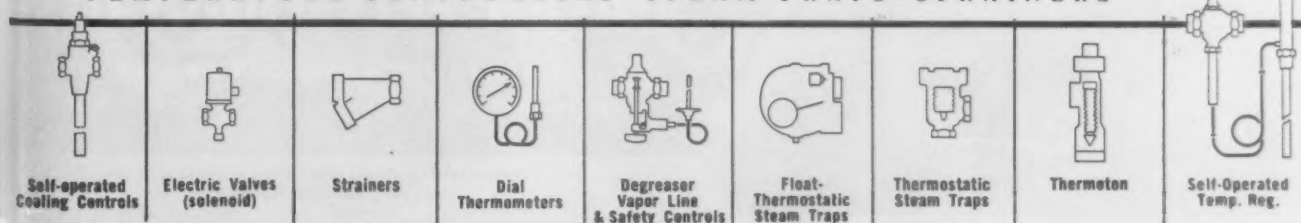
Sarco LSI Electric Temperature Controller

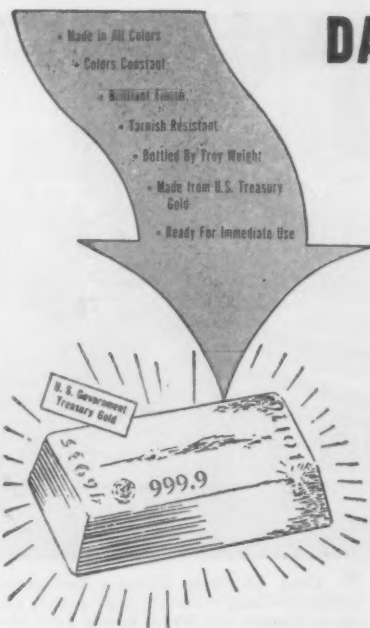
Can hold bath to $\pm 1^\circ$ F.; settings changed by turning one knob. Provides automatic control of heating and cooling to help prevent:

- Changes in current density
- Variations in plate thickness
- Variations in quality
- Dull finishes
- Breakdown of plating solutions
- Crystallization of salts

2023 C

TEMPERATURE CONTROLLERS • STEAM TRAPS • STRAINERS





- Made in All Colors
- Colors Constant
- Brilliant Finish
- Tarnish Resistant
- Bottled By Troy Weight
- Made from U.S. Treasury Gold
- Ready For Immediate Use

DAVIS-K GOLD PLATING SOLUTIONS

67% POTASSIUM GOLD CYANIDE SALTS

LUSTROUS WHITE RHODIUM SOLUTION

THE ONE OUTSTANDING DEVELOPMENT IN GOLD PLATING
DURING THE PAST QUARTER CENTURY

DAVIS-K

ONE OPERATION

Antique Gold Solution

TANK RHEOSTATS: We are pleased to announce our variable type tank rheostats which are specially designed for precious metal plating.

DAVIS-K SERVICE: Our service today with its newly expanded facilities is fast and efficient. We are fully equipped to reclaim your old gold and rhodium solutions. Phone or write your precious metal problems. We welcome them!

"Where Glittering Elegance Reflects Lasting Quality."

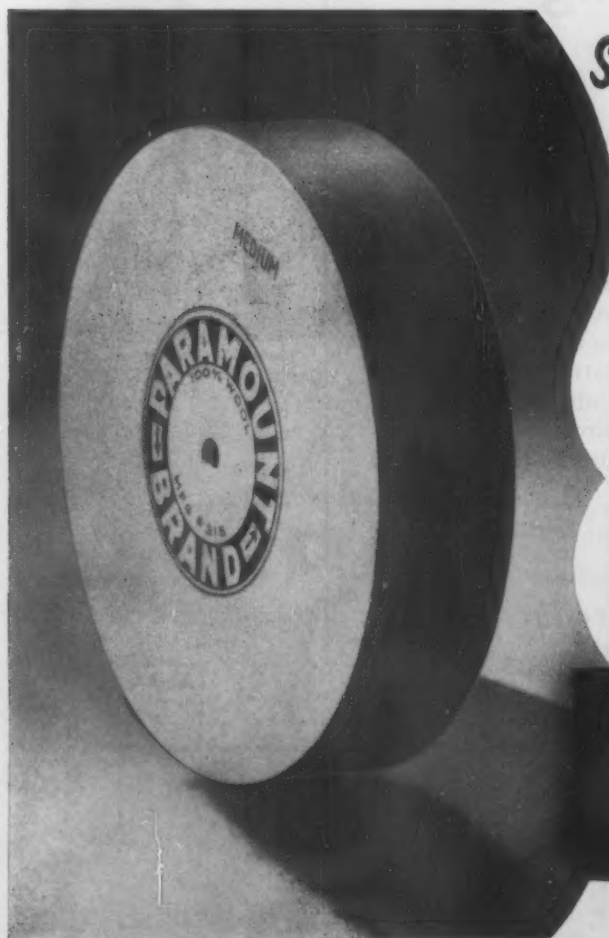


DAVIS-K PRODUCTS CO.

135 West 29th St.

Longacre 4-1978-9

New York 1, N. Y.



Solution to tough polishing problems

SET-UP WHEELS

... the felt wheel by *Paramount*
... the abrasive grain by your
favorite manufacturer

Whether you work with metals as soft as aluminum or as hard as steel, it's 20 to 1 your polishing applications call for abrasive grains in the 120-240 range. It's here that eye-appealing finishes are born — and it's the very range where Paramount Felt Wheels set up with the proper abrasive can do the most for you — both quality- and cost-wise.

Discover for yourself why hundreds of manufacturers call Paramount Felt Wheels the versatile work-horses of their polishing rooms — call your supply house today.

BACON FELT COMPANY

437 WEST WATER STREET • TAUNTON • MASSACHUSETTS
Established 1825 "Felt Does It Better"

New 12-page catalog shows ways you can profit with felt
write for your copy today.

**Establishing New Sales Records for
Manufacturers of Highly Styled Products**

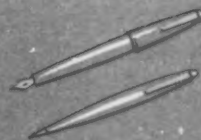
Sel-Rex

**Bright
Gold
Process**

**Hard, mirror-bright and corrosion
resistant surfaces at no greater cost**



Automotive



Pens and Pencils



Household Appliances

Leading manufacturers have proven that it costs no more to add an air of luxury... sales-making customer appeal to their products with the Sel-Rex BRIGHT GOLD PROCESS. Rich, mirror-bright surfaces that are hard and corrosion resistant are produced without scratch brushing or buffing—at costs that compare favorably with ordinary finishes. Sel-Rex BRIGHT GOLD PROCESS requires no special equipment and operates at room temperature.

Let us demonstrate how the Sel-Rex BRIGHT GOLD PROCESS can improve your product... create greater sales—at low cost. Get a trial order of the Sel-Rex BRIGHT GOLD PROCESS, or write for complete data to meet your particular specifications.



Sel-Rex Precious Metals, Inc.

229 MAIN STREET

BELLEVILLE 9, NEW JERSEY

Manufacturers of Sel-Rex Silver Sel-U-Salt and Bright Rhodium



Accessories



Watches and Jewelry

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CHRISTMAS

"Many, merry Christmases,
friendships, great accumulation
of cheerful recollections,
affection on earth and Heaven
at last for all of us."

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